J. T. Brell

LECTURES

ON

MATERIA MEDICA AND THERAPEUTICS,

DELIVERED IN THE

COLLEGE OF PHYSICIANS AND SURGEONS

OF THE

UNIVERSITY OF THE STATE OF NEW YORK.

BY

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TO THE

Alumni of the College

OF

PHYSICIANS AND SURGEONS

OF THE

University of the State of New York.

GENTLEMEN—

I dedicate these Lectures to you in the hope that in their present shape they may meet with a portion of that favor with which you received them when they came from the lips of the Author.

C. R. GILMAN.

J. T. Small.
Toronto

PREFACE.

In presenting these Lectures to the friends and admirers of the late Dr. Beck, and especially to the Alumni of the College in which he labored so long and so faithfully, a word or two explaining my own connexion with them seems to be proper. After the death of my friend I was informed that he had partly prepared his Lectures for the press, and was requested to look at the papers and give an opinion as to whether they were in a state fit for publication, and if so to prepare them for the press. With this request I felt very reluctant to comply. Quite a number of circumstances seemed to me to point out another person for this duty; and for myself, I felt that neither by previous study nor by habits of thought was I at all reasonably fitted for this task. There existed, indeed, but one reason why I should be selected, and that, having undertaken the duty, I have placed with a pride deeply mingled with sorrow upon the title-page. We were friends. For twenty-five years of constant intercourse no shade of doubt, distrust, or ill-feeling, passed between us. This, and deference to the wishes of one whose devotion to his happiness when living, is only equalled by her zealous interest in his fame when dead, induced me to undertake this labor. I found, on examination, that on most subjects the Lectures had been re-written with apparent care; on others this was done only partially; and in one or two instances the leaves of the old Lectures were intermingled with very small portions of the new manuscript. Such was the form in which these Lectures came into my hands. Though well aware of the great amount of labor which the preparing of such a mass of matter for publication would involve, I did not shrink from it; I believed that the

lectures contained a valuable digest of the present state of knowledge in this department, and that they would be acceptable to the profession and useful to medical students. Whether my estimate was the dictate of sound judgment or of partial friendship, the profession into whose hands I now commit the work will, of course, decide for themselves. In preparing the work for the press my agency has been *merely ministerial.* Where the manuscript was re-written and free from verbal inaccuracies, it passed out of my hands untouched; where it seemed to me that the language could be made more clear, verbal alterations have been made; where, as happened in a very few instances, a fact was stated inaccurately, the statement was corrected; further than this I did not feel at liberty to go. The opinions are those of Dr. Beck, not of his Editor. In some cases these opinions are contrary to those which I have formed, and been in the habit of teaching; still they were his, and I did not attempt to modify or impugn them. In a few places I have added a few words where I thought by doing so I could make the book useful to students; in all cases these additions, "*ne illo imputantur,*" are included in brackets. To these remarks there are two exceptions of sufficient importance to be specially noticed and explained. On examining the manuscripts I found proof of a fact of which I was before cognisant, viz. that on many of what are called the "New Remedies," Dr. Beck did not lecture. He was in truth, as these Lectures in almost every page will prove, not a runner after new things; his study was much more into the indications of treatment, the circumstances modifying the operation of medicines, and those kindred topics which I should call the philosophy of Materia Medica, than into the character and claims of new and fashionable therapeutic agents. This explains the fact that many "new things" found no place in his Lectures. I had no disposition to alter them: in this respect I shared his opinions, and concurred heartily in his plan of teaching. Still there were two subjects which I supposed it proper to introduce into the book, although I found no notice of them in the Lectures. One

was, to be sure, a new and fashionable, and a most extravagantly vaunted agent, Cod Liver Oil; still it appeared to me that in a matter with which the mind of the profession is at present so much occupied, something ought to be said. I have, therefore, prepared an article which I hope may not be useless. The other subject to which I referred is Anæsthetics. These agents have been introduced during the period of Dr. Beck's failing health, and he never lectured on them. He knew that they were noticed incidentally by two of his colleagues, Dr. Parker and myself, and that I devoted considerable time to a rather full consideration of the whole subject; hence he felt the less necessity for treating of them. When, however, his Lectures came to be presented to, the profession "in a book," and especially when they were offered to students as a text-book of Materia Medica and Therapeutics, it was obviously proper that a consideration of these agents, whose use is so wide-spread, and whose utility is scarce now a subject of doubt, should appear in it. I accordingly prepared an article on Anæsthetics, in which, while I have tried to do justice to a class of remedies, the introduction of which into practice is, I firmly believe, a great boon to humanity, and when used in the particular department of the healing art to which I have for years devoted most of my time and thought, enables us to rob labor of half its sorrows and almost all its terrors, I have at the same time, and even with more earnest efforts, labored to impress on the minds of those as yet unfamiliar with their use, the lessons of caution and watchfulness without which I know these agents are and must be *ministers of death.* On the question of how far I have succeeded in this task, I feel very great solicitude; I am, I hope, ever mindful of the responsibility which attaches to one who earnestly commends to the notice and the favor of the profession a practice which has, we know, destroyed more than a score of lives, and which many believe has been fatal to a much larger number. I know that in urging upon the profession the *duty*, for such in certain cases I deem it, the duty of using Anæsthetics, I may be instrumental in the destruction of human life; and I desire,

by the most earnest warnings, by cautions in season and out of season, to clear myself of any responsibility for fatal events, which may and must result from the careless use of these drugs. Used with constant care, watched with unceasing vigilance, they are safe and most beneficent agents; used rashly and thoughtlessly, they are so dangerous, so almost certainly fatal to life, that such use of them involves, in my judgment, an amount of moral guilt little short of that which attaches to manslaughter. To impress these opinions, and the consequent cautions, on the readers of the article on Anæsthetics, was the motive constantly present to my mind in its preparation. If I have succeeded, if those who read it gain from it lessons of care, caution, and watchfulness, I shall be satisfied; if not, better, far better that it had never been written. In conclusion, I have to acknowledge valuable assistance from Professor Lewis C. Beck in the revision of the article on Proximate Principles; and to confess my own obligations for the matter I have added, to Pereira, whose book, a great storehouse of valuable knowledge in the whole subject of Materia Medica, I have consulted with confidence, and used when I needed it with freedom.

MATERIA MEDICA

AND

THERAPEUTICS.

INTRODUCTION.

By the Materia Medica, in its largest sense, is meant that branch of Medical Science which treats of the history, preparation, properties, and effects upon the living system, in health and disease, of all the various agents which are used for the prevention or cure of disease. It may, therefore, be considered as including two distinct departments—viz. *First,* What may be called strict *Materia Medica,* embracing simply an account of the history and properties—physical and chemical—of medicinal agents, and of their effects on the system in health. *Second, Therapeutics,* That which relates to the effects of these agents in their applications to the management of disease. It is in this extended sense that I propose to consider it in the following course of lectures; and I shall, therefore, besides giving you a description of the various properties of medicines, endeavor to lay before you the general principles which are to govern you in their use.

There are several points of view in which medicines are generally considered in the books—viz. their natural history—their physical, their chemical, and finally, their therapeutical properties.

With regard to the *natural history* of medicines, it is not my intention to go into any minute botanical or mineralogical descriptions. To do this would alone fill up a course of lectures, and would be occupying your time to but little purpose, as it regards the more important objects which ought to be held in view. I shall, however, give such general, concise notices of their natural history as may be more immediately applicable to practical purposes; referring those who feel an interest in the subject to the Dispensatories for fuller information.

Under the head of *physical properties* I shall call your attention particularly to such circumstances as may assist you in ascertaining the purity of the article as used in medicine. This is a subject, gentlemen, of great importance, and one not sufficiently attended to. To those who know to what an extent the adulteration of medicines is carried, and how often, from this cause, the expectations of the physician are frustrated, it will scarcely be necessary to say anything to show the importance of such knowledge as shall enable the practitioner to be certain that he is really giving the medicine which he has ordered. In the next place, of their *chemical properties.* Chemistry, gentlemen, has conferred immense benefits upon the Materia Medica; and a knowledge of the chemical properties of medicines is no less necessary to the mere practitioner than it is to the scientific physician. By discovering the active principles of vegetables, it has enabled us to separate them from inert matter, and thus not merely to improve the mode of their administration, but to increase their activity. For a striking illustration we need go no further than the Peruvian Bark. Whoever compares the unwieldy and nauseous doses of this article as formerly given, with the elegant and condensed preparation made from it in the form of the sulphate of quinine, must at once admit the utility of chemical knowledge as applied to the Materia Medica. In addition to this, a knowledge of the chemical properties and relations of medicinal substances to each other, is the only thing which will enable the practitioner to avoid that very *great* though common error of giving articles which decompose each other, and thus, either neutralize the powers of each, or produce compounds whose effects are entirely different from those inteuded.

With regard to the *Therapeutical properties*, these are the most important, and they shall claim the principal share of attention. To them a knowledge of all the other properties is only subservient. This is a part of our subject of no small difficulty. The virtues ascribed to medicines are so multifarious, and if we are to believe the reports of different writers, so positively contradictory, that it requires the soundest exercise of judgment, connected with no small share of experience, to decide what are really the effects of medicines upon the living system, and how they may be rendered available in the cure of diseases. And as we cannot in all cases call in question the accuracy of the statements of distinguished men, however contradictory they may at first sight appear, it will frequently become a subject of philosophical and instructive inquiry to investigate the causes of this discrepancy. Such investigations are worthy of the highest efforts of intellect, as their object is to show that medicine is not an *uncertain art*, but a *science*, built upon fixed and rational principles. The principles upon which these investigations will be conducted are exceedingly simple, and are the following: Without entering into any process of reasoning to establish it, the proposition may be assumed, *that under similar circumstances the same medicines will produce similar effects.* This is a self-evident proposition; and by

carefully applying it, we shall be able in many, if not in most cases, to arrive at a satisfactory solution of the contradictory accounts which are upon record in relation to the effects of medicines. In all cases, therefore, in which the effects of the same medicine are reported to be different, the first question to be determined is, *was the medicine really the same?* From the ambiguity of nomenclature, and the successive fluctuations which it has undergone from accidental circumstances, or from progressive improvements in science, it will not unfrequently be found that the same term has been applied to substances totally distinct in their character.

Independently, however, of this general error resulting from the confusion of terms, there are other circumstances which require investigation to ascertain the character of medicines. The virtues of medicinal vegetables especially, we know, depend much upon the season of the year in which they are collected—upon the part of the plant used—upon the mode of preparation—upon the length of time they have been kept, &c., &c. So greatly do all these circumstances modify the character of medicinal substances, that illustrations might be given in abundance, in which, from ignorance or inattention, some of the most powerful articles in the Materia Medica have been rendered perfectly inert. Having determined the character of the medicine given, the next subject of inquiry is to ascertain the *circumstances under which it was given.* Here an extensive field of investigation opens upon us. *Was the disease the same?* It is familiarly known that diseases passing under the same name differ essentially in their general type and character. *What was the stage of the disease in which the medicine was given?* If these questions cannot be determined with some degree of certainty, it is useless to object that the medicines are *uncertain* in their effects. Besides these, there are constitutional differences in patients which modify very greatly the effects of remedies, such as temperament, age, sex, habits, occupation, &c. Now, to appreciate justly the effects of remedies, all these circumstances are entitled to consideration, and in many cases they will lead to a solution of the contradictions which are found in medical writers. From the view just given, it is evident that the Materia Medica presents a wide field for practical study as well as philosophical research. In general interest and utility it yields the precedence to no department of medical knowledge. In the circle of the sciences, it holds a most important station. It is the connecting link between strict Medicine and the collateral sciences, Chemistry, Botany, Mineralogy, and Zoology; while to the Therapeutical part of it every other branch of medical science is subservient. In conducting a course of instruction on a subject so important my object will be twofold. In the first place to spread before my class the material facts and principles which constitute the science of the Materia Medica, and in the second place to endeavor to give such a direction to your minds as shall encourage you to think and reason for yourselves. Essential as is the *first* of these objects, it

is far exceeded in importance by the *second*. There is no science which, in its practical applications, calls for such incessant exercise of the reason and judgment as medicine; and if I shall be so fortunate as to aid in any good degree those who hear me, in disciplining their minds to habits of thought and reflection, my highest ambition, as a teacher, will be gratified.

As preliminary to the consideration of medicines in detail, it will be necessary to make some general observations in relation to their effects, as well as the various modes in which these effects are propagated throughout the system.

Of the Effects of Medicines.—The effects of medicines are divided into two classes—*Physiological and Therapeutical.* By the first, are meant the ordinary immediate effects which are produced on the system without reference to disease. By the second, are meant those effects which exhibit themselves in the alleviation or removal of the various morbid conditions under which the system may be laboring. Thus, for example, an emetic, if given a short time before the expected return of a paroxysm of intermittent, will frequently prevent it altogether. In this case, the nausea and vomiting which the emetic produces are physiological effects; while the prevention of the paroxysm is the therapeutical effect. Now, the distinction between these effects is obvious and important, and ought always to be kept in view. At present our business is only with the physiological effects. The therapeutical will properly come to be considered when we treat of the application of remedies to the management of disease.

Physiological Effects.—These are divided into *local* and *remote.* By the first, we mean those impressions which the medicine makes upon the part with which it comes in immediate contact. By the second, those which are the consequence of the local ones, and which show themselves in distant parts of the system.

Of the Local Effects.—In general, it may be said that there are two ways in which medicines may act upon the part to which they are applied. In the first place, they may act upon it chemically. They, then, corrode and destroy it. Ordinary caustics applied to the surface of the body, furnish an illustration of this mode of action. In the second place, they may act by modifying the vital properties of the part. The modes in which the vital properties may thus be influenced, are various both in kind and degree. In some cases, the sensibility and irritability of the part are increased, and a *stimulant or irritant* effect is produced. Stimulants of various kinds, introduced into the stomach, produce upon the mucous membrane of that organ such an effect. So, also, in a still more striking manner, do rubefacients and blisters applied to the surface. In these cases, the nerves and blood-vessels are both implicated in the impression which is made. That the nerves are affected, is evident from the heat and increased sensation, while the redness and distension show the effect on the

blood-vessels. In other cases, the sensibility and irritability of the part, instead of being increased, are impaired, and then a *sedative* effect is produced. Here the impression seems to be limited in a great measure to the nerves, without involving materially the blood-vessels. Of this mode of action, opium, aconite, and other narcotics furnish illustrations.

In other cases, again, the local impression amounts to nothing more than exciting the absorbent vessels to which they are applied. This is the mode of action of many of those articles which are carried into the general circulation, and whose effects are manifested only in the relief of morbid conditions of the system. The local effects of the same remedy will vary:

1st. According to the part of the system to which it is applied, *e. g.* when applied to the eye, brandy will produce a very different effect than when introduced into the stomach.

2d. According to the state of the part at the time—*e. g.* to the inflamed stomach, the effects of wine are very different from those to the stomach in health.

The remote effects, as already stated, are developed in different parts of the system. Like the local effects, they differ in character—some are stimulating and others are depressing—some alterative. Between the local and remote effects, it is important to remark that there is no necessary similarity in the nature of their action. A medicine, for example, may be a stimulant to the part to which it is applied, and yet depressing to other parts of the system. An emetic, for example, is exciting to the stomach itself, but remotely depressing to the vascular system. Colchicum proves irritant to the stomach and bowels, while in its remote action it lowers, very strikingly, the circulation. No inference, therefore, can be drawn from the local action of a medicine, as to its remote effects.

These differ, also, greatly in the *parts* of the system where they develope themselves. In some cases, the *mucous tissue* is the part remotely affected, as is shown in the increase or diminution of its secretions.

In some cases the *nervous system* is the part remotely acted on. Thus opium acts locally on the stomach and remotely upon the brain and nerves of the system generally.

Sometimes the *vascular system* is the part upon which the remote impression is chiefly developed. Digitalis, for example, acts thus in a remarkable manner upon the heart and blood-vessels. In other cases, again, the *glandular system* is chiefly affected. In this way mercury acts upon the salivary glands; iodine on the breast, thyroid, and other glands of the system.

In a great number of cases the remote effects of medicines, instead of being thus limited to particular parts, are developed in several conjointly. Thus mercury, in its remote agency, involves the mucous, the vascular, the nervous, and the whole glandular system.

Of the manner in which these Effects are Produced.—With regard to the local effects, our knowledge is confined within very narrow limits. All that we can say about it is, that the medicine, whatever it may be, comes in actual contact with a living surface, and produces upon it peculiar effects corresponding to the nature of the substance applied and the particular susceptibility of the part to which it is applied. In short, our knowledge does not extend beyond the simple expression of the fact itself. *How* it is, or *why* it is, that such effects are produced, are subjects entirely beyond our comprehension.

With regard to the *remote* effects, the question which presents itself is of a different character—In what way is it that medicines, when locally applied, are capable of producing effects on different parts of the system? How is it that agents taken into the stomach, or applied to the skin, can affect the brain, the lungs, the kidneys, the uterus, &c. This is a question by no means of easy solution, and has been greatly embarrassed by the theories and speculations of ingenious men. In discussing it, I shall endeavor to keep aloof from these theories, and confine myself to such views as may be sustained by fact as well as argument.

There are only two ways in which different parts of the system can hold intercourse or be acted upon by one another. The first of these is through the medium of the *nerves;* the second through the medium of the *circulation.* It is only in one or the other of these two ways, therefore, that the effects of medicinal agents can be produced in distant parts of the system. In other words, the impression made by the medicine upon the part to which it is applied must be conveyed sympathetically, by reflex action, to other parts; or the medicine must be taken into the circulation and actually carried to different parts of the system, and thus produce its remote effects. A candid review of all the parts connected with the subject will lead us, I think, to the conclusion that in neither of these modes *exclusively* are the remote effects of medicines produced; but that, while in some cases they are produced by sympathy, in others, and that the very great majority, they are the result of absorption into the circulation; and these are the points which I shall endeavor to establish.

In the first place, *of the production of the remote effects by sympathy.* The human system is so constituted that no part of it is completely isolated from the rest. Impressions made upon one portion of it are extended with different degrees of force to others. An incessant intercourse is thus kept up throughout the complicated machinery of the animal economy, and the agents through which this is accomplished are the nerves, ramifying through every fibre of the system. Now that some medicinal agents act through the nervous system is beyond doubt, and this is proved not so much by the rapidity with which these effects are evolved, though that was formerly much relied on, as by the character of the agents that produce them. Thus, for example, ammonia held to the nostrils almost imme-

diately rouses from a fit of fainting; a feather applied to the same part causes sneezing; the finger in the fauces causes vomiting, &c.

Now in these cases, as well as many others which might be adduced, the effect is doubtless produced through nervous agency. Experiments made upon animals with certain poisonous agents were thought to show this in a still more conclusive manner. By Magendie, the extremity of a glass tube, previously dipped into a phial containing pure prussic acid, was plunged into the throat of a strong dog. The tube had scarcely come in contact with the tongue before the animal made two or three long and rapid inspirations, and fell dead. No method that could be devised enabled him to trace the smallest sign of sensibility in the muscular organs of this animal after death.

An atom of the acid was applied to the eye of another dog; the effects were as sudden and as fatal as in the preceding experiment.

A drop of the acid, diluted with four drops of alcohol, was injected into the jugular vein of a third dog. The animal fell dead that instant, as if struck by a cannon shot or by lightning.*

By Mr. Brodie, two ounces of proof spirit were introduced into the stomach of a rabbit, and produced perfect insensibility almost before the injection was completed.

One drop of the essential oil of *bitter almonds* applied to the tongue of a cat caused instant convulsions.

Three ounces of the infusion of tobacco injected into the rectum of a dog produced immediate contractions of the voluntary muscles.

Less than a drop of empyreumatic oil of tobacco applied to the tongue of a young cat caused instant convulsions.†

By Dr. Christison, a dog was killed in less than three seconds by introducing into the left femoral vein two drops of *conia*, neutralized with muriatic acid and diluted with thirty drops of water.‡

The foregoing illustrations are sufficient to show the rapidity with which impressions may be conveyed from one part of the system to another, and they were declared to be inexplicable, except upon the supposition of transmission through the nerves. Many advocates of this doctrine of the action of medicines by sympathy, as it was formerly called, went so far as to claim for it the exclusive control of the operation of medicines; but more accurate investigation has robbed the great argument from rapidity of action of all its force, by proving that absorption may take place in an astonishingly short time—a time quite within that in which the most violent poisons act. Blake says that the time in which a substance may be absorbed by the capillaries, and diffused throughout the body, may not

* Brande's Journal of Arts and Sciences. Vol. iv. p. 348.

† Eclectic Repertory. Vol. ii. p. 270.

‡ On the Poisonous Properties of Hemlock and its alkaloid Conia. By R. Christison, M. D. From the Trans. of the Royal Society of Edinburgh, p. 33.

exceed nine seconds. These experiments on the rapidity of absorption, and the exposition of the mode of operation of the reflex system of nerves, have thrown a flood of light on this formerly obscure subject.

In the second place, *of the production of the remote effects by the absorption of medicines into the circulation.* In the investigation of this point two things require to be noticed. 1st, Are medicines actually absorbed? and, 2d, Are the remote effects the result of this absorption?

Strange as it may appear, notwithstanding the multiplied proofs to the contrary, it has been actually denied, and that by writers of authority, too, that medicines are ever taken into the circulation, and the most elaborate and ingenious efforts have been made to establish this doctrine.

In every discussion it is essential to settle two preliminary points: and these are, precisely what the question at issue is; and then, what the kind of evidence is which is necessary to establish or refute it. In the present case the question is this—Do or do not certain medicines enter the circulation? and the kind of evidence necessary to determine it must be that of fact and experiment. This is the only kind of evidence which can settle it. General reasonings can do nothing more than show the probability or improbability of it. Further than this they cannot go, and, therefore, as opposed to actual fact, they can be accounted of no moment. I make these observations because some of the writers to whom I have alluded, in their discussions of this subject, overlooking the evidence of facts, appear to me to have trusted almost entirely to general speculations, a species of argumentation altogether inapplicable. To settle this question, then, all we have to do is, to ascertain from actual observation or experiment whether or not substances introduced into the alimentary canal or applied to the surface can afterwards be detected in the fluids or solids of the system. It is altogether a question of fact, not of argument. Let us then see what is the evidence furnished by well attested facts in relation to this subject.

For, if it can be shown from observation and experiment, that substances introduced into the alimentary canal are afterwards found in the chyle—in the blood—in the secretions, and excretions, and finally in the solids of the body, then it is proved beyond a peradventure that they do actually enter the circulation. Let us see if this can be done.

Of the Chyle.—Of the presence of foreign substances in the chyle, we have several striking proofs. Into the jejunum of a dog, who had been kept fasting for a day previous, Dr. Musgrave introduced twelve ounces of a *solution of indigo* in fountain water. After three hours, the dog was opened again, when several of the lacteals were observed of a bluish color, showing the presence of the indigo in these vessels. Other experiments of a similar kind were made, with like results by him.*

* Philosophical Transactions of London. Percival's Essays, Vol. ii. p. 317.

By Dr. Fordyce, a solution of *indigo* was injected into the intestines of a sheep, and the chyle afterwards found quite blue.*

By Tiedman and Gmelin, *sulphate of iron* was detected in the chyle of a horse who had taken it. *Prussiate of potash* was found in the chyle of a dog, and *sulphuro-prussiate of potash* in the chyle of another dog, to whom it had been given.†

The foregoing facts appear to me sufficient to show that foreign substances may, and do actually, sometimes at least, get into the chyle, and in that way pass into the circulation. That this is the usual route, however, which they take, is disproved by numerous experiments. This has been shown particularly to be the case with colored substances. As the result of all the experiments with regard to coloring matters, it would appear that although occasionally they may get into the chyle, yet as a general rule, when they pass into the circulation, they do so through another route, and that is through the blood-vessels.‡ With regard to certain saline substances, the case is different. Prussiate of potash, the article generally used in the foregoing experiments, not merely enters the chyle, but does so with great facility. In experiments made by Lawrence and Coates, upon thirty-four animals, sixteen indicated the presence of this salt in the chyle.§

In the Blood.—That foreign substances taken into the stomach are afterwards found in the blood, is still better established than their presence in the chyle. On this point, the experiments are numerous and unequivocal. The following substances have been detected by experimenters worthy of credit: bromine, iodine, lead, copper, mercury, arsenic, silver, tin, iron, antimony, zinc, bismuth, barium, various salts of potassium, sal ammoniac, nitre, sulphuretted hydrogen, quinine, hydrocyanic acid, various vegetable coloring principles, oxalic acid, turpentine, alcohol, camphor, and a few odorous principles.

The proof, then, that medicines and other agents, being absorbed, are found in the blood, is full and conclusive; and though long denied by a class of visionary theorists, is now generally received. Foreign substances have also been detected in the various secretions—the proof of this we shall now state. In the urine, among the most curious and interesting facts on this subject, are those reported by Stehberger.

* A Treatise on the Digestion of Food. By G. Fordyce, M. D. etc. London, 1791. p. 122.

† Philadelphia Journal of Medical and Physical Science. Vol. iii. p. 153.

‡ It is to be recollected that none of the experimentalists mentioned above, express any doubt at all of the entrance of foreign substances into the circulation—the only question being whether they enter it through the medium of the lacteals and thoracic duct, or through that of the veins, a question which, however interesting in itself, has no important bearing on the present discussion.

§ Philadelphia Journal of Medical and Physical Science. Vol. v. p. 328.

His experiments were made under the superintendence of Tiedman. The subject was a young man, thirteen years of age, who was affected with congenital extrophy of the bladder. The posterior wall of the bladder formed at the lower part of the abdomen a projection of three fingers' breadth, which was red and fungous, always moist, and sensible to the touch. The urine issued continually from the ureters, which were completely exposed, and admitted of the secretion of the kidneys being collected perfectly pure and unmixed. When any substance had been administered, the urine was collected every ten minutes until indications of it were perceived. It was then examined every quarter or half an hour, until the urine had returned to its original character. In this manner, the progressive augmentation or diminution of the foreign substance was observed. The period which elapsed between the swallowing the different articles, and their appearance in the urine, was as follows: madder was perceptible in 15 minutes, indigo in 15, rhubarb in 20, gallic acid in 20, decoction of logwood in 25, the coloring principle of myrtle berries in 30, black cherries in 45, the astringent principle of uva ursi in 45, the pulp of cassia in 55, prussiate of iron in 60, rob of elder in 75. The complete disappearance of substances from the urine was as follows: prussiate of iron in three hours and three quarters, indigo four hours and a half, rhubarb six hours and twenty minutes, decoction of logwood in six hours and three quarters, uva ursi seven hours and twenty minutes, myrtle berries eight hours and three quarters, madder nine hours, gallic acid eleven hours, pulp of cassia twenty-four hours.*

These experiments are eminently interesting, not merely as establishing the general fact that foreign substances do get into the urine, but as showing the rapidity with which some of them get there, as well as the length of time which they continue to pervade that fluid.

By Wohler, a still more extensive series of experiments are reported, the object of which was to show not merely that foreign substances pass off by the urine, but, in addition to this, to point out the changes which they undergo in their passage through the system. The results, as stated by him, are that some pass off by the urine decomposed, others in a state of new combination, while others pass off unchanged. Those which are *decomposed* are the following: the tartrates, citrates, malates, and acetates of potash and soda, changed into the carbonates of the same alkalies; sulphuret of potassium, changed into the sulphate of potash. Those which enter into *new combinations* with substances which they find in the body, are the following: sulphur, changed into sulphuric and hydrosulphuric acids; iodine, into hydriodic acid; oxalic, tartaric, gallic, succinic, and benzoic acids, into combinations with an alkali. Those which pass *unchanged* are the following: carbonate, chlorate, nitrate, and sulphate

* New York Med. and Phys. Journal, V. vi. p. 130.

of potash; hydrosulphate and hydrocyanate of potash; protoxide of iron, borate of soda, muriate of barytes, silicate of potash, tartrate of nickel and potash; the principles of many coloring matters, such as indigo, gamboge, madder, logwood, beet-root, mulberries, and cherries; several odoriferous principles, somewhat altered, such as the oil of turpentine, juniper berries, valerian, assafœtida, garlic, castor, saffron, and opium.*

Still more recently, Orfila has detected the presence of arsenic in the urine of man as well as of animals poisoned by it. By him, *antimony*, too, has been found in the urine of persons who have been put upon the use of that substance. In one patient, who took twenty-four grains of tartrate of antimony in the course of twenty-four hours for pneumonia, he obtained a sufficient quantity of the metal to exhibit it to the Academy of Medicine. In another patient, who took twelve grains in twenty hours, he detected the metal in the urine, voided twelve hours after its administration. In experiments upon animals with the salts of copper, he discovered the presence of the metal in the urine.†

Of the Milk.—In animals, it is well known that the milk partakes of the character, as to taste, smell, and color, of the peculiar vegetables upon which they have been feeding. Thus garlic, peppergrass, and the like, impart their taste to the milk of cows, as well as the butter made from it.

By Chevallier, Henry, and Peligot, some interesting experiments were made upon the milk of asses, to whom various substances were administered, and it was found that distinct traces of many remedial agents were detected in it. Of these, common salt was found in abundance; sesquicarbonate of soda passed in great quantity into the milk, rendering it alkaline. Traces of sulphate of soda, when given in doses of about two ounces, were readily detected; iodide of potassium was readily identified, when administered in doses of a drachm and a half; oxide of zinc, tris-nitrate of bismuth, and sesqui-oxide were also found.‡

In the human subject, *iodine* has, in more than one instance, been discovered in the milk. A woman in Grey's Hospital had been taking, for a fortnight, three times a day, iodine with hydriodate of potash. On testing her milk with sulphuric acid and starch, iodine was detected.§ According to Wallace, the milk of a nurse taking iodine has not merely indicated its presence, but it has been found in the urine of the child at the breast.‖

By M. Vallet, *iron* was found in the milk of a woman under treatment

* New York Med. and Phys Journal, vol. v. p. 624.

† Johnson's Journal for Oct. 1840, p. 438.

‡ Johnson's Journal, vol. xxxvii. p. 380.

§ Johnson's Journal, vol. xxxvii. p. 380.

‖ London Lancet for March 26, 1836, p. 6.

with carbonate of iron. In women in health, he did not find iron in the milk.*

Opium sometimes, too, acts upon the child in this way. Barbier relates a case, in which he saw an infant narcotized for several hours, in consequence of having sucked the milk of a nurse who had a short time before swallowed a large dose of laudanum for cramp in the stomach.† A similar case is related by Dr. E. D. Smith, on the authority of the late Prof. Barton, of Philadelphia.‡

That the specific effects of *mercury* may be produced in the child through the milk of the nurse, is established by the best possible evidence, which is the cure of the venereal disease in the infant. Although it would not be safe in all cases to trust exclusively to this mode of introducing mercury into the system of the child, yet the controlling influence of the remedy given in this way, has been noticed in too many cases to admit of any doubt.§ In the Medical Essays and Observations of Edinburgh, too, cases are related in which the yaws were cured in children, by giving mercury to the mother.‖ The production of catharsis in the nursing child, by purges given to the mother, is familiarly known to all. It is worth remembering that there are some articles which do not produce this often disagreeable effect as frequently as others. Those which are least likely to affect the child are olive and castor oils, confection of senna, and compound extract of colocynth. The salines are most likely to do harm in this way.

Of the Saliva.—Iodine has been detected in the saliva of persons under its use by Canter¶ and by Dr. A. T. Thomson of London.** By Dr. O'Shaughnessy, it was found in the saliva of a dog that had been poisoned by it. The same fact is confirmed by S. Wallace.†† That *Lead* taken internally makes its way into the saliva appears to be now well established, although I am not aware that the metal has been actually identified in this fluid, yet the peculiar effects produced by it upon the saliva and the gums are sufficient to prove its actual presence there—these are the bluish color of the saliva, and a peculiar discoloration of the gums. That lead sometimes produces an increased flow of saliva and renders it of a bluish color, had been noticed by more than one observer; but the discoloration of the gums caused by it was first described by Dr. Henry Burton, in a paper contained

* Journal of Pharmacy, vol. x. p. 253.

† Traité Elementaire de Matière Medicale, par J. B. C. Baubier. Tome ii. p. 702.

‡ Caldwell's Thes., vol. i. p. 244.

§ On this subject, see Swediaur on Syphilis, p. 330. B. Bell on the Venereal, vol. ii. p. 263. Colles's Practical Observations on the Venereal Disease, p. 169. Hamilton on Mercury, p. 47. Ryan's Midwifery, p. 483.

‖ Vol. vi. p. 278.

¶ North Amer. Med. and Surg. Journal, vol. vii. p. 432.

** Johnson's Journal, vol. xxix. p. 215. †† London Lancet, N. S. vol. vii. p. 613.

in the Transactions of the Royal Medical and Chirurgical Society of London, for 1840. According to him, "the edges of the gums attached to the neck of two or more teeth of either jaw, are distinctly bordered by a narrow leaden blue line, about the one-twentieth part of an inch in width, whilst the substance of the gum apparently retains its ordinary color and condition." This discoloration is so peculiar, that when once seen, it may afterwards be recognised without any difficulty. It is very permanent too, having continued for months and until after death; a few hours after death it appears more distinct than during life. Besides this, it is not an occasional, but a constant occurrence in persons under the influence of lead.* Now, that the bluish color of the saliva and this blue line on the gums, depend upon the actual presence of the lead, in some shape or other, can hardly be questioned. Pereira explains it by supposing that a sulphuret of lead is formed by the action of sulphuretted hydrogen, evolved by the lungs on the lead contained in the salivary secretion.

In confirmation of this opinion he adds, that he has seen "an alloy of mercury and silver, introduced into the hollow of a tooth, become coated in a few days with a black film of metallic sulphuret."†

Of the Perspiration.—By Dr. A. T. Thomson, *iodine* has been detected in the perspiration of those using it,‡ and the same has been done by Canter.§

That *sulphur* taken internally passes off by the skin, cannot well be questioned. When continued for any length of time the perspiration gives out a smell of sulphuretted hydrogen. Articles of gold and silver worn by the patients are blackened, and sometimes their linen is tinged yellow.‖

That *mercury* passes off by the skin, is proved by the blackening of the skin, which has been known to follow its use after the administration of sulphur. A case of this kind quoted by Pereira, is related by Rigby (Lond. Med. Rep. for April, 1837). In this case the sulphur and mercury are both thrown out by the skin, furnishing the black sulphuret of mercury on the surface.¶

Dr. Granville found that by giving ten grains of rhubarb daily for a week before labor, the liquor amnii and the blood from the divided vessels of the cord, as well as the first urine voided by the child, contained rhubarb.

* For many interesting details in relation to this subject, see Trans. of the Royal Med. and Chir. Society of London, vol. xxiii. p. 63.

† Pereira's Materia Medica, vol. i. p. 653, Am. Ed.

‡ Travels in Europe, Africa, and Asia, made between the years 1770 and 1779. By Charles Peter Hornbey, M. D., 3d Ed., London, vol. iv. p. 83.

§ Christison on Poisons, p. 13.

‖ Lon. Lancet, April 9, 1842, p. 37.

¶ Dict. Mat. Med. Par Merat et Lens, vol. iv. p. 452.

Of the Bones and soft Solids.—That the bones of animals fed upon madder are colored red has long been known, and what is curious is, while it thus tinges the bones, it does not affect in any way the soft solids. The oldest writer who notices this interesting property of madder, appears to have been Lemnius, in his treatise *De Miraculis occultis Naturæ.* He was a physician of Zealand, a country in which the madder has been cultivated from the earliest periods. His work was published in the year 1564.* It did not, however, attract any attention until a much later period, about a century ago, when an English surgeon by the name of Belchier accidentally observed that the bones of some pork brought upon the table were red. On inquiry, he ascertained that it was occasioned by the animals feeding on the water mixed with bran in which cotton cloth was boiled, and which was colored by the madder used in printing it. By subsequent experiments he convinced himself that the coloring of the bones was owing to the madder. In 1736, he communicated the discovery to the Royal Society of London in a paper which was published in their transactions.† Recent experiments not only confirm the fact, of which indeed there is no doubt, but prove also that the bones are tinged by other substances. Dr. Milnor of Philadelphia found that the bones of a cat fed for several days on *Prussian blue* and *Indigo*, exhibited the blue color "in a remarkable degree."‡ Even the bones of the fœtus have become colored by feeding the parent animal on madder. To show this, some highly interesting experiments were made by Professor Mussey, now of Cincinnati. He caused a sow to be fed daily during the last eight weeks of her gestation on madder. On the day the farrow was produced, several of the pigs were killed and their bones inspected, when every bone was found strongly tinged with red. In another experiment, a sow was fed for twenty days on madder. She was then bled to death, and half a dozen nearly full grown pigs found in the uterus. On examination, all the bones of the pigs were of a reddish color. The bones of the sow, too, were dyed of a fine red approaching scarlet.§

That the *skin* becomes permanently affected by the internal use of *Nitrate of Silver* is now established by so many cases, that no doubt can exist on the subject. This interesting fact appears to have been first noticed by Swediaur, who relates the case of a protestant clergyman, near Hamburgh, who took, by the advice of an empiric, some Nitrate of Silver for an obstruction of the liver; after continuing the use of it for some months, his skin began to change gradually, until at last it became almost black. This color continued for several years, and then began, as is stated,

* Beckman's History of Inventions and Discoveries, vol. iii. p. 276.

† Philosophical Transactions, vol. xxxix. pp. 287, 299.

‡ Philadelphia Journal of Med. and Phys. Sciences, vol. iv. p. 14.

§ Am. Jour. Med. Sc. vol. v. p. 20. For a detail of facts on this subject, accompanied with some judicious reasoning, I must refer to Christison on Poisons, p. 290.

to diminish.* Subsequent observation has not only established the fact, that the Nitrate of Silver does blacken the skin, but also that the same hue is communicated to the mucous membrane of the stomach and bowels.

A curious case is related by Wedemeyer of an epileptic, who was cured by Nitrate of Silver, but died afterwards of diseased liver and dropsy. His skin had previously acquired the bluish tint—on examination after death, all the internal parts were found similarly discolored, and on chemical examination metallic silver was found by M. Brande, in the plexus choroides and pancreas.†

Besides the facts already detailed, the recent experiments of Orfila with *Arsenic*, *Tartar Emetic*, and the *Salts of Copper* furnish the most overwhelming evidence of the absorption of these articles, and of their subsequent appearance in the *solid viscera*, both of animals and of the human subject. In several cases Arsenic has been extracted by him after death from the *liver* of persons poisoned by it.

I have thus in a summary way detailed a number of facts from which the following conclusions may safely be drawn:

1. That both in man and in animals, foreign substances may and do get into the circulating fluids.

2. That among these are several medicinal agents in ordinary use.

With so many positive proofs of the absorption of various articles, it is reasonable to infer too, that when the range of experiments shall be sufficiently extended, and the processes for detecting substances shall have become sufficiently improved, we shall be able to establish the same in relation to a great number of agents concerning which we have at present no certain evidence. In the meantime, it ought to be recollected, that the fact of our not being able to detect the presence of any article in the fluids furnishes no certain proof that it does not actually exist in them. This is a point which has been argued with great clearness by Dr. Christison, in relation to poisons, and it holds with much greater force in its application to ordinary medicines. Among others, the two following reasons seem most conclusively to establish this. In the first place, the quantity of the article which enters the blood, may be too small to admit of detection, after being distributed throughout the body. Thus Sir Edward Howe found that a quarter of a grain of Prussiate of Potash could not be detected in two ounces of the serum of the blood. It required to be increased to a whole grain before the usual tests indicated its presence.‡ In the second place, many substances entering the blood may undergo such changes as to render their detection by chemical reagents impossible. Of

* La Medicine eclairée par les Sciences Physiques, &c. Fournoy. Tom. i. p. 342. Lond. Med. Chir. Trans., vol. vii. p. 292.

† Brande's Journal of Science, new series, vol. vi. p. 430.

‡ Philosoph. Trans. of London for 1808, p. 53.

this Dr. Christison gives a striking illustration. He injected into the femoral vein of a dog eight grains and a half of oxalic acid, which caused death in thirty seconds. Yet he could not detect it in the blood of the iliac vein and vena cava collected immediately after death.*

These considerations unquestionably prove that substances may exist in the blood and yet not be cognisable by the ordinary tests.

That certain medicinal substances are taken into the circulation is then proved beyond question. This being so, another point remains to be settled, and this relates to the precise mode in which their effects are finally produced. The prevailing opinion is that the medicine, after being introduced into the current of the circulation, is carried to different parts of the system and produces its effects by actual contact with the parts or organs in which its agency is developed.

In concluding the whole subject of the modus operandi of medicines, the propositions which in the present state of our knowledge are entirely defensible, are

1st, That medicines differ in the manner in which their effects are produced.

2d, That some produce their effects through the nerves or by sympathy.

3d, That some are absorbed into the circulation and produce their effects in consequence of such absorption. As to the mode in which agents introduced into the general mass of the blood come to affect one organ rather than another, our knowledge is very limited; we can hardly go beyond the expression of the fact, that certain substances have under such circumstances a tendency towards one organ rather than another, or perhaps that one organ has, as a part of its peculiar vitality, a special susceptibility to be affected by one agent when that is presented to it in the blood.

The discussion of the modus operandi of medicines is not a mere subject of speculation; on the contrary, it has practical bearings of great importance, and it is on this account that I dwell upon it.

1. Medicines are modified in their effects by a great variety of circumstances, and in the treatment of many diseases it may be a matter of very great importance to determine whether the medicine which may be used produces its effects through the agency of the nerves, or by being absorbed into the circulation. In many diseases the fluids are manifestly changed in their condition, and these again react upon the solids. Is it unreasonable then to suppose that medicines, if absorbed into the circulation, must exert from this very circumstance some peculiarity in their operation.

2. If medicinal substances be taken into the circulation, they must impregnate fluids secreted from the blood. Now milk is one of these; and if this fluid can be thus impregnated, the sucking child must inevitably be-

* On Poisons, p. 14.

come affected. Besides if it can be proved that the articles taken into the stomach are introduced into the milk, it must necessarily modify the effect of it even as an article of diet, and may thus exert a most material influence over the whole constitution of the child. In addition to all this, if the milk can be thus charged with medicinal agents, it may be found exceedingly useful as a vehicle for administering certain medicines at an early period of life, by giving to the mother.

2. It is important in its application to medical jurisprudence. It has been found that most poisons are absorbed, and that they are eliminated from the system mainly through the urine. If this be so, the urine ought to indicate their presence. Again, in the treatment of poisons, if they pass off by the urine, the more the quantity of urine is increased, the more likely is the poison to be passed off also. Diuretics, therefore, are a class of remedies which may be made very useful here.

You perceive, that this description of the modus operandi of medicines involves a great many points of great practical importance; this, and the curious and interesting character of the facts by which absorption has been proved, has induced me to go into greater detail than I should have otherwise done, as the main question is now scarcely a debated one.

Of the various parts of the Body to which Medicines are Applied.—There are three different modes in which medicines may be brought to act on the system, viz. by applying them to *some portion* of the *mucous membrane*, by applying them to the *skin*, and lastly by injecting them *into the veins.*

Of the Application of Medicines to the Mucous Membrane.—Almost every part of this membrane may be made the seat of medicinal application, and in every case important effects may be produced. In the relative value and extent of these effects, however, there is a wide difference, according to the part of the membrane to which the medicine is applied.

The Mucous Membrane of the Stomach.—This is the surface to which medicines are usually applied and from which effects are obtained, as a general rule, more prompt and important than when applied to any other part. The reason is obvious. Abundantly supplied with nerves, a primary impression may here be made with great effect. Placed, too, in the very centre of the system, and holding the most direct and constant intercourse with all the important organs of the body by means of its nervous communications, the stomach possesses a power of transmitting impressions unequalled by any other part. Besides this, it is supplied with a profusion of absorbing vessels, through whose agency substances may be introduced into the circulation and thus carried to the remotest parts; over and above all this, it is the simplest and readiest mode of introducing medicines into the system. It is therefore generally resorted to, and in describing the effects of medicines it is always to be understood that this is the mode

unless the contrary be stated. The doses of medicines, too, are always stated in reference to this mode.

The Mucous Membrane of the Large Intestines.—To this, medicines are also frequently applied and with great effect. It possesses, however, less sensibility than the mucous membrane of the stomach, and therefore requires a larger dose of the medicine to produce the same amount of effect, as absorption is less active. Nothwithstanding all this, medicines when applied here act with great efficiency, and not merely the local but the remote effects are obtained in the same way as when they are applied to the stomach.

The Mucous Membrane of the Nostrils.—Medicines are sometimes applied to the surface and make a powerful impression, not merely upon the part itself, but extend their effects to other parts of the system. The vapor of ammonia, by the impression which it makes on the nerves of smell, produces a general effect upon the whole system.

The Mucous Membrane of the Lungs.—The only way in which medicines can be applied here is by inhalation in the form of vapor, and as a general rule, the object had in view is to obtain their local effect upon the part itself, and they are employed for the correction of certain morbid conditions of this membrane. Notwithstanding, it is quite certain that impressions thus made may be extended to other parts of the system.

The attention of the profession has been very strongly directed to this mode of administering medicines by the general use of Anæsthetics, but of them hereafter.

Besides the foregoing, there are other portions of the mucous membrane to which medicines are continually applied, such as the *eye*, the *ear*, the *urethra* and *bladder*, the *vagina* and *uterus*. In all these cases, however, the only object is to obtain certain local effects from the remedies, though the remote or so called constitutional effects may follow, as for example, Belladonna has produced its constitutional effects when applied to the os uteri to favor dilatation.

2. *The next Mode of bringing Medicines to act on the System is by applying them to the Skin.*—Blisters, rubefacients, frictions, cold and warm bathing, &c., all produce their effects in this way. Moreover, many medicines usually introduced into the stomach may be made to produce all their ordinary effects, by applying them to the surface, and this is frequently a mode of great value. The skin is an extensive surface, plentifully supplied with nerves, and hence possessing great sensibility. It is capable, therefore, of receiving the primary impressions of medicines. An objection to the use of medicines in this way arises from the greater density of the epidermis as compared with the epithelium; this modifies external impressions, and delays, though it does not prevent, absorption. To obviate this difficulty, two methods are resorted to—the one is to overcome it by *frictions*, so as to bring the medicine in contact with the sensitive

portion of the skin; the other is to *remove the cuticle altogether*, by means of a blister, so as to enable us to apply the medicine to the denuded surface. The first of these methods is called the *Iatraliptic method*, the other the *Endermic method*.

Iatraliptic method. This consists in the application of medicines by means of friction to the skin. This method, although formally brought into notice only a few years since, was practised from the earliest periods of our art. It was evidently known to Hippocrates,* Diagoras, Celsus, as well as Aretæus, who all allude to it. To the Arabians it appears also to have been familiar. To a modern physician, however, Dr. Chrestien of Montpellier, in France, is due the credit of reviving and systematizing the practice.

The mode of using remedies in this way is, first, to reduce them to a state of minute division, then dissolve them in some suitable menstruum, and in this state rub them on the skin. According to Chrestien, remedies act most efficiently when dissolved in some of the natural fluids of the body, such as the saliva, gastric juice, or bile. Generally, however, he mixed them with grease, oil, water, or alcohol; and he states that he did not perceive any great difference in the facility with which they were absorbed. To produce the same effect by the external application of a medicine, requires always double, or triple, and sometimes ten times the quantity it does when taken internally.

That some medicines applied to the skin by friction are capable of producing the same effects as when taken into the stomach, is a fact well known. Thus, mercury rubbed in the form of ointment on the surface, produces salivation with as much, if not more certainty and rapidity, than the internal administration of the metal. Frictions with ointment of gold will produce all the specific effects of that metal on the system.† A strong decoction of tobacco rubbed on the epigastric region, or on the skin of the

* Hippocrates prescribed medicinal frictions to promote the flow of the menses. Diagoras applied opium in the same way. Celsus speaks of the cure of dropsies by unctions of squills. Aretæus employed those of aloes upon the stomach, in diseases of that organ.—Dict. Nat. Med. vol. ii. 2, p. 582.

† Castor oil, applied to the abdomen by friction, according to Sigmond, will affect the bowels the same as if taken internally, especially if aided by the warm bath. He states that "obstinate constipation has yielded to this remedy, and where such violent and constant sickness has been present as to preclude the possibility of the internal administration of the oil, it has produced all its good effects without adding to the distressing state in which the stomach is found. I have seen, by these means, an action produced upon the bowels within a quarter of an hour after the friction has been employed, immediately on the patient leaving a bath of the temperature of 98°, where calomel, jalap, neutral salts, and lavements had failed to relieve the intestinal canal, and when constant vomiting had commenced, and all idea of internal remedy had necessarily been abandoned.—Johnson's Journal, vol. xxvi. p. 493.

Croton oil, it is also asserted, will produce its usual effects on the bowels, particularly if combined with castor oil.—Ibid.

head, will cause nausea and vomiting. Belladonna or stramonium rubbed on the eyebrow will dilate the pupil as certainly as when taken inwardly. Tincture of cinchona rubbed on the spine has cured intermittent fever, when the internal exhibition of it has failed.* Digitalis and squills too, rubbed on the skin, have excited the action of the urinary organs and cured dropsy.

The foregoing facts are sufficient to show that by friction on the surface, the effects of certain medicines may be fully obtained on the system.

Endermic method.—This practice consists in first removing the cuticle from a portion of the skin, and then applying medicines to the denuded surface. This method is of recent origin, and we are indebted for it to M. Lambert, by whom it was first practised in one of the French hospitals, in 1828.† In this method, the first thing to be done is to separate the cuticle. The best mode of doing this is by the application of a common blister of moderate size, say about four inches square. The only objection to it is the length of time which it takes to blister. When it is desirable to apply the medicine as speedily as possible, the cuticle may be separated by the use of a pomade made of equal parts of lard and strong liquor ammoniæ.‡ By renewing this every five minutes, a blister will speedily be raised.§

The best part of the body for making the application is the epigastrium. Having separated the cuticle, the medicine is applied in the state of fine powder, or if it be too irritating, incorporated with cerate or lard. Applied in this way, a number of agents have been found to produce all their ordinary effects on the system. Among them are the *sulphate of quinine, the acetate and sulphate of morphine, strychnine, belladonna, stramonium, hyosciamus, aconitine, aloes, gamboge, and colocynth, squill, and digitalis.*

From the experiments which have been made, it will appear that medicines applied in this way act as promptly as, and sometimes more so than, when taken internally. Frequently, too, they do not require to be used in

* Broussais cured intermittent fever in this way. Phlegmasiæ, vol. ii. p. 242. See also on the effects of the external application of bark, Dr. H. Jackson in Caldwell's Theses for 1806, p. 173; also Dr. S. Pye, in Lond Med. Obs. and Inq. vol. ii. p. 245.

† Essai sur la Méthode Endermique par Ant. Lambert. Paris, 1828.

‡ Johnson's Journal, vol. xxii. p. 176.

§ Where an instantaneous blister is required, the following has been recommended: "Cut a piece of cotton, linen, or of paper, of the size and shape for which it may be required; immerse this in spirits of wine, in strong brandy, or in eau de Cologne; lay it on the surface to be blistered, wiping the edges, so that none of the fluid may moisten the surrounding parts; apply a lighted candle rapidly over the whole surface, that it may be burnt immediately. The ignition is exceedingly quick, and the cuticle will be found separated from the subjacent cutis."—Johnson's Journal, vol. xxvi. 494.

On the endermic method, see also British and Foreign Review, vol. v. 343. Lon. Med. Gazette, Nov. 1838, p. 233. Dunglison's Intelligencer, vol. iii. p. 50. Madden on Cutaneous Absorption, p. 138.

larger doses, though generally they require double the dose. A great objection to this mode is, that it sometimes produces a good deal of local irritation, causing painful and tedious sores. This I have witnessed myself in some of the first experiments which I made at the New York hospital with the sulphate of quinine.

(Many of the substances above noted produce, even when diluted, extreme pain, and they should be used in delicate, nervous subjects with great caution; especially are they likely to do harm in children. I have known at least one case of fatal convulsions produced in this way.—Ed.]

3. *Injecting into the Veins.*—This is the last mode of introducing medicines into the system that requires notice. The first person who made any attempts at ascertaining the effects of medicines introduced into the veins appears to have been Dr. Wren,—then of Oxford. As early as the year 1665, he made experiments upon dogs by injecting into the veins of the hind legs *opium* and the *crocus metallorum.* The dog in whom the opium was injected was stupified, but did not die. In the other, vomiting and death were the consequences.* About two years afterwards experiments of a similar character were made at Pisa, by Frascati. Some of the mineral acids were injected into the veins of dogs. These proved fatal.

The first attempt made to inject medicines into the veins of the human subject appear to have been made about 1667 by Dr. Fabritius of Dantzick. The experiments were made upon three individuals—one male and two females—by injecting into the vein of the right arm a laxative solution. In all of them, a purgative effect was produced on the bowels, besides which they vomited freely. Two did well; one of the females, on the day following the operation, took cold from exposure and died.† In the next year, 1668, Smith, a physician of Dantzick, experimented upon two venereal patients, by introducing alterative medicines into the veins. One of these died, the other recovered. The same experiments were tried the same year upon three other patients—one laboring under the gout, another apoplexy, and a third plica polonica—all are said not only to have borne the operation well, but to have been cured of their respective complaints.‡

These were the earliest experiments of the kind made, and they certainly show that medicines may be injected into the veins both of man and of animals without proving fatal, and that their effects may be produced upon the system. Since then various other experiments have been made with the same view. In 1823, Magendie injected warm water into the veins of a patient at the Hotel Dieu, laboring under hydrophobia. It had the effect of quieting the spasms, but he nevertheless died at the end of some

* Hale's Boylston Prize Questions, p. 72.
† Philosophical Trans. for 1667. Hale, p. 74.
‡ Hale, p. 76.

days. The same was tried in three other patients. In all it arrested the convulsions, without however saving the patients.*

Still more recently, aqueous and saline fluids have been, in large quantities, injected into the veins, and in a few cases with apparent advantage, in Asiatic cholera.

From all these experiments it appears that medicines may be introduced into the veins—and that they produce the same effects, and even more promptly, as when taken into the stomach. Nevertheless, the practice is attended with too much danger to be resorted to except in very extraordinary cases.

Relative value of the different modes of introducing medicines into the system.—Having thus noticed the different modes in which medicines may be brought to bear upon the system, I shall make a remark or two upon their comparative value. As a general rule there can be no question that the ordinary mode of introducing medicines into the stomach is in every respect the best. Both the local and remote effects of medicines are produced more naturally and easily in this way than in any other. There is less trouble and inconvenience attending the administration, matters of no small importance. For ease and safety, then, this is to be preferred as a general practice. Cases and occasions, however, may occur in which some of the other modes are to be preferred. Such for instance as the following:—1. When the stomach will not retain medicines, and they are rejected by vomiting, or are passed by the bowels. A familiar instance of this is met with in using mercury as an alterative. It frequently, even when combined with opium, causes such a free action on the bowels as to interfere with its effects. In this case introducing it by friction on the surface is a most valuable and certain resource. 2. When some physical obstruction to swallowing occurs. 3. When some peculiar idiosyncrasy prevents the taking of medicines by the stomach. 4. In some cases in children from the difficulty of getting them to swallow medicines.

In all these cases the external application may be suitable and preferable. Of the different modes of applying them externally, the Iatraliptic may be preferable in some cases, and the endermic in others. This must be determined by the nature of the case and the character of the remedy to be applied. With regard to injecting medicines into the veins, it is a practice attended with too much hazard to warrant its adoption, except in cases of diseases intractable to the ordinary modes of treatment—such as hydrophobia, tetanus, and the like.†

Of the various circumstances modifying the effects of medicines.—The human system is not always the same. It differs at different periods of life, in different climates, and under various circumstances. It is very evident, therefore, that the impressions made upon it must also

* Dict. Mat. Med., vol. iii. p. 610.

† Dict. Mat. Med., vol. iii. p. 612.

vary. In making out, therefore, a full and complete history of the effects of medicinal agents, it becomes necessary to analyse in detail all the circumstances which have an influence in modifying the condition of the system.

1. *Age.*—This modifies the condition of the human system, and, of course, the effects of medicinal agents. In infancy all the textures are exceedingly delicate, and much more easily affected by impressions made upon them than at any subsequent period. This is particularly the case with the mucous membrane and the skin, the two surfaces to which all medicinal agents are applied. The brain and nervous system, too, are more delicate, and exercise a more predominating influence over every other part of the body. Hence it is that the brain is so easily excited by irritations, and that convulsions and organic diseases of this organ are so common at this early period. The vascular system, too, is now in a condition entirely different from what it afterwards comes. Not merely is the power of the heart and blood-vessels much less, but there exists a great difference in the relative size of the arteries and veins, as well as in the quantity of blood which they circulate. In advanced life, in all these respects, the system has undergone a complete revolution. The tissues, from being soft and delicate, become dense and firm—their sensibility is lessened and the activity of their functions lessened. The brain and nerves, from being soft, become firm and solid—their functions are impaired, sensation is blunted, and all the motions impeded. From this change it happens that pain can be much better borne in old age than in infancy. The blood-vessels, too, now become more solid, in many cases even ossified, and the venous blood in the system now bears a much larger proportion to the arterial than it did at previous periods. Hence it is that venous congestions are so common. From all this it is very evident that the system undergoes a great change, and it would seem as a matter of course that the effects of agents applied to it must be greatly modified by these changes, and such indeed is proved to be the case by observation and experience. It will accordingly be found that almost every medicinal agent is more or less modified in its operation according to the period of life at which it is administered. For example, emetics are given at all ages, and yet how different are their general effects. In infancy vomiting is excited with little or no difficulty, and so far as the mere mechanical process is concerned, attended with no danger. If, however, some active article be used, even in doses suitable to the age, the consequences may be fatal. Tartar emetic has thus been known to produce vomiting which ended in death. In advanced life, on the other hand, from the impaired sensibility of the organs concerned, vomiting is not so readily excited, while the mechanical process, which in children is attended with no danger, is now frequently destructive of life, owing to the tendency which there exists at this period to venous congestion of the brain.

Cathartics afford a second illustration. In the early periods of life, as a general rule, this class of medicines operates much more readily than they do afterwards. As we advance in years, the intestines, in consequence of their repeated stimulation, have their sensibility impaired and their contractile power lessened. In consequence of this condition of things, cathartics make less impression upon old people, and accordingly they require to be used in much larger doses, and the more active articles selected. On the other hand, again, it is to be recollected that the intestines of children are more liable to be lined with collections of viscid mucus; and when this is the case, they can bear much larger proportional doses.

Opium furnishes another illustration. While to adults this drug may be given with perfect safety, in its effects upon children there is frequently nothing so uncertain. Not unfrequently the simplest preparations of it, and administered, too, in reasonable doses, have been attended by alarming and even fatal symptoms. The syrup of poppies and Paregoric have both operated occasionally in this way.

I shall notice only one other illustration, and that is *Venesection*. This is a remedy resorted to, and very properly, at all ages; and yet in many cases it is to be feared without due regard to the difference of effect produced by it. As a general rule, children do not bear the loss of large quantities of blood so well as adults. One or two bleedings, even though very young, they may bear. If carried any further they sink under it. Nor do they recover from syncope, when induced by venesection, so readily as adults. On the contrary, such is the deficient reaction in them that this state is always attended with more or less danger. In old age, the same general rule holds good. Moderate quantities of blood may be abstracted with beneficial effect, while the loss of large quantities is followed by great prostration of the powers of life.

The foregoing illustrations, selected from a thousand others which might be adduced, are abundant to show the importance, nay, necessity of investigating the effects of remedies at different periods of life. Unless this be done, it is idle to suppose that they can be properly or even safely employed in the treatment of the various diseases to which the human frame, from infancy to old age, is liable.

2. *Sex.*—This modifies very greatly the condition of the human system, and it must, therefore, also as a matter of course modify the effects of medicinal agents. As a general rule, the constitution of females is much more delicate than that of males. Their nervous system is also much more excitable. Hence impressions are more easily made upon them by medicinal agents. The more active articles accordingly require to be used with much greater caution in them. In venereal hospitals it has been observed that only half the quantity of mercury is necessary to produce precisely the same effect as in males. Independently of the general deli-

cacy of constitution, there is another circumstance attending the female which greatly modifies the effect of remedies, and that is a state of pregnancy. During this state, women bear blood-letting much better than at any other period; for the purpose of subduing disease, it is frequently necessary to carry it to a much greater extent than under the ordinary conditions of the system. Tonics, on the other hand, are not borne so well, and do not appear to produce precisely the same effects. The Peruvian bark, accordingly, very frequently fails under these circumstances to arrest the paroxysms of intermittent fever. In the advanced stages of pregnancy, the use of emetics is frequently followed by a premature expulsion of the fœtus. It is very evident, then, that sex greatly modifies the effects of remedies, and for their just use and administration all that requires to be thoroughly understood.

3. *Peculiar Habit and Constitution of Body.*—This modifies very greatly the effects of remedies. Ceteris paribus, fat persons are vomited with more facility than lean ones. As a general rule, fat persons have less blood in proportion than lean ones, and on that account do not bear the loss of such large quantities. In delicate and irritable habits, blisters cause a great degree of nervous and vascular excitement, attended not unfrequently with the most distressing effects on the system at large. There is, perhaps, no medicine which shows in a more striking manner the modifying effects of temperament than mercury—an article which, in robust constitutions, may be given with impunity, in nervous and irritable habits, especially, if carried to any extent, is followed by effects the most disastrous, augmenting general irritability, and predisposing the system to the invasion and development of various and even fatal diseases.

4. *Climate and Season.*—By the powerful effect which these exercise upon the human frame, they exert a modifying influence on the effects of remedies. So fully was the celebrated Baglivi impressed with the truth of this, that he frequently adds, in giving an account of his treatment, "Vivo et scribo in ære romano." Celsus has observed, that "medicines differ according to the nature of the climate; one kind being necessary in Rome, another in Egypt, and a third in France." To the same effect Baglivi says, that "The Spaniards, any more than the Italians, if their physicians may be credited, cannot well bear rough medicines of any kind." By some it has been supposed that in hot climates, and in warm weather, venesection was a remedy which ought not to be resorted to for fear of the debility which it might induce. Erroneous as this opinion certainly is, there nevertheless can be no doubt that under certain conditions of season and climate, this evacuation can be better sustained by the constitution than it can under others. As a general rule it is more indicated and better borne during the winter and spring than it is at other seasons. In dry weather, too, it is better supported than it is in moist weather. Yet, as a

general fact, the natives of moist and foggy England bear bleeding better than Americans; it depends, probably, on their mode of life.

Hillary remarks, that in Barbadoes, under equal circumstances of pain, inflammation, and other symptoms, he always found the blood much less sizy and buffy than it was in England, and a consequent modification of the treatment was called for.

Mr. Boyle says the same of the coast of Africa.

During the prevalence of the sirocco, it has been observed in Egypt, as well as in Italy, that, owing to the depression occasioned by it, sedatives cannot in any case be with safety administered.

The effects of mercury, too, are modified very greatly by the nature of the season and the climate. In hot climates it is much more difficult to bring the patient under the influence of this remedy, than it is in more temperate regions. On this account it is, that such large quantities are required and used in tropical regions. Independently, however, of mere temperature, certain regions seem to be adverse to the kindly operation of this metal on the human system. In Egypt, according to Baron Larrey, the use of mercury, even in venereal disease, requires the greatest caution. If used with the same freedom as in Europe, it produces hepatic and various other affections.

5. *Habit.*—This greatly modifies the effects of many medicinal agents; but its influence is not the same in all cases: it diminishes the susceptibility of the system to the impression of some medicines—it greatly increases it to that of others. Opium furnishes a striking illustration of the first of these. The quantity of this drug that can eventually be borne, after the system has been habituated to it, is really astonishing. The Malays will swallow from 20 to 30 grains, daily, with perfect impunity; and in civilized society, persons have been known to take almost any quantity without suffering any inconvenience. Mercury, on the other hand, observes a different law, and the system, so far from becoming habituated to its use, becomes more and more sensible to its operation. When a person, for instance, has been salivated several times, the smallest quantities of mercury will sometimes produce the most violent effects.

6. *The actual condition of the System at the time of taking the Medicine, with regard to health and disease.*—Of all the circumstances which modify the effects of remedies, this is the most striking and important. Medicines do not always produce the same effects in a state of disease which they do in perfect health. In different diseases, too, the effects of the same remedy differ entirely—almost every remedy and every disease furnishes an illustration of these facts. In apoplexy, for instance, the most active emetics fail to produce their ordinary effect. In certain diseased states of the intestinal canal, and of the system, the most drastic cathartics can be made to produce little or no effect. In delirium tremens, quantities

of opium have been given with very little effect, which, in the ordinary conditions of the system, would inevitably have been followed by apoplexy and death. In tetanic and neuralgic affections, unaccompanied by inflammation, narcotics may be given to the greatest extent without producing any of their ordinary effects. In congestions of the brain, and inflammation of serous membranes, immense quantities of blood can be taken without producing syncope, while in other diseases, particularly of an irritative character, the system succumbs immediately to the loss of the vital fluid.

I have thus, in a general way, noticed some of the circumstances modifying the effects of medicinal agents. When I come to treat of them in detail, all these circumstances will necessarily come again under review, for more special and particular consideration.

Of the Classification of Medicinal Agents.—In every department of knowledge, a general classification of the various subjects embraced in it is of the greatest utility. It simplifies the science, and thus facilitates the acquisition of it. It is, in fact, nothing more than a generalization of otherwise individual and detached facts, by some principle of common relation. Any principle may be adopted as the basis of a classification, and almost every classification will be found to give rise to new combinations and interesting analogies. It is not to be inferred, however, that it is a matter of indifference what classification is adopted; on the contrary, not a little of the interest, as well as character of the science, may depend upon the selection which may be made. The principles which, it appears to me, ought to be chiefly held in view in the construction of a classification of the Materia Medica, are the following:—In the first place, the basis of it should not be theories, but *well established facts.* Unless it be so, it is evident that the classification must be fluctuating in its character, at the same time that it may lead to serious practical errors. In the second place, as the great object of this science is the investigation of the effects of medicinal substances upon the human system with a view to the cure of disease, such a classification should be preferred as is best suited to the attainment of this object.

By keeping these principles in mind we shall be able to form a pretty correct estimate of the value of the classifications which at various periods have been offered.

Among the earliest attempts at arranging the articles of the Materia Medica was that of classifying them according to their sensible properties, such as color, smell, taste, &c. Such a classification has the advantage of being founded on plain and obvious properties appertaining to medicinal substances, and this, so far as it goes, is much in its favor. It presents also a very interesting view of the analogies of these substances so far as their sensible properties are concerned. And if these properties furnished any true index of their medicinal effects, the classification would be unexcep-

tionable. Such, however, is not the case, and it fails, therefore, in the principal object for which an artificial arrangement may be useful.

The next attempt was founded on the *botanical relations* between plants. This of course can apply only to vegetable medicines, and on that account is defective on the basis of a classification which ought to embrace all medicinal agents whether animal, mineral, or vegetable. So far, however, as it can be applied it has been attempted by Murray* and De Candolle. It is liable, however, to the same objection with that founded on the sensible qualities of substances, inasmuch as the natural affinities lead to no certain conclusions in relation to the medicinal properties of plants.

By some the chemical properties of substances have been adopted as the basis of classification. This is evidently, however, the very worst that could be chosen, both for the uncertainty and imperfections, even at the present day, of the analysis of vegetable substances, and from its leading to no certain conclusions concerning the effects of medicines upon the living system.

The last principle adopted as the basis of a classification is that of the medicinal properties, or, in other words, of the effects which they produce upon the living system. Of all the systems, this embraces the greatest number of advantages, and is the most decidedly practical and useful in its applications. Like the others, however, it is very far from being perfect. This arises from the limited extent of our knowledge in relation to the animal economy, as well as of the effects of medicinal substances upon the system. It is in consequence of this that so many different classifications have been proposed, all based upon the same common principle, but varying in the application of that principle according to the particular views which may be entertained in relation to the laws of the animal economy and the action of remedies. All this will be found abundantly illustrated by an analysis of the classifications of Cullen, Murray, Young, and indeed every other modern writer on the subject of the Materia Medica. In their details, however, all these classifications are liable to objection.

By some, medicines have been classified according to the particular part or tissue of the system upon which they are supposed to exert a special influence. This is the basis upon which the classifications of Alibert and Eberle are founded. Specious as this is, it is nevertheless obnoxious to an objection which is insuperable. With the exception of those agents which are purely local in their operation, there is no medicine which is limited in its effects to any particular part of the body. Directly or indirectly, it extends its action more or less to other portions of the system. In applying it, therefore, to individual articles, the principle of the classification is

* Essai sur les proprietés médicales des plantes, comparées avec leurs formes extérieures et leurs classification naturelle. Par M. Aug. Pyr de Candolle, Prof. &c. Seconde edition. Paris. 1816.

constantly violated. For example, opium, in a classification of this kind, is placed under the head of those agents which exert their influence on the nervons system; and so it does—but besides this it also exerts an influence on the vascular system, on the skin, on the liver, on the urinary organs, and thus the very principle of the classification is contradicted. So also with almost every other agent. This, therefore, can never furnish a solid fonndation for a classification.

From what has been said, it must be obvious how difficult, if not impossible, it must be to frame a classification that shall be unexceptionable. In the one which I propose as the basis for the present course of lectures, my only objects will be simplicity and convenience, and I shall arrange medicines according to their more prominent and acknowledged effects on the system, first into Six Great Classes.

1. Evacuants.	3. Narcotics.	5. Revulsives.
2. Depressants.	4. Excitants.	6. Alteratives.

The first class I subdivide into nine orders, as—1st. Emetics, 2d. Cathartics, 3d. Anthelmintics, 4th. Sialogogues, 5th. Diaphoretics, 6th. Diuretics, 7th. Expectorants, 8th. Emmenagogues, 9th. Parturients.

Of Depressants, I make three orders, viz.—1. Sedatives, 2. Refrigerants, 3. Demulcents.

Narcotics I do not divide.

Of Excitants there are four orders.—1. Stimulants, 2. Antispasmodics, 3. Tonics, 4. Astringents.

Of Revulsives two, Internal and External.

Of Alteratives two, Vital and Chemical.

ON THE COMBINATION OF MEDICINES.

(*Condensed and Abridged from Barbier.*)

Of the Combination of Emetics with other Medicines.—For very obvious reasons the combination of emetic medicines with those of other classes must be exceedingly limited. They would, as a matter of course, be ejected before they could produce any decided effect. Some combinations, however, of importance are in use. There are only three cases in which emetic medicines may be combined with other medicinal agents, viz.:—

1. When the emetic medicine enters into the composition in so small a quantity that it cannot excite vomiting.

2. When the matters associated with the emetic are only auxiliary to its operation as an emetic.

3. When by the union of different ingredients the emetic is decomposed and loses its property.

Combination of Emetics with Tonics.—These generally do not admit of combination. *Tartar emetic*, especially, is decomposed by most of the vegetable *tonics* and *astringents*, and therefore if united, the emetic property is destroyed. This is the case with cinchona, nut galls, columbo, &c. Hence vomiting, too, by tartar emetic may be arrested by the administration of a decoction of Peruvian bark.

Emetics with Stimulants.—Combinations of these are not uncommon in pharmacy. The wine and tinct. of ipecac are instances. So also if tartar emetic be dissolved in alcohol. In all these the effects of the emetic and stimulant are observed. In analysing the effects of these compounds, we shall find that the stimulant property shows itself first; that it exalts the sensibility of the digestive passages, and thus gives more scope to the subsequent impression of the emetic ingredient. This combination is useful in cases of poisoning by opium, or where the stomach is rendered torpid by the poison. Here antimony acts much more powerfully and promptly, if given in alcoholic solution. This combination is also useful in cases of coma, &c., where you wish to vomit the patient, and the stomach is torpid.

Emetics with Demulcents.—If tartar emetic or ipecac be mixed with gum arabic, or any other gummy or oleaginous matter, the effect is to weaken their action and to diminish the force of their impression. The mucilaginous matter also relaxes the tissue of the digestive organs, and renders them less sensible to the force of irritating substances in the alimentary passages.

Emetics with Refrigerants.—Here two things are to be considered: the chemical action of vegetable acids upon the emetic substance, and the refrigerant action of those acids upon the organs where emetics exert their power. Tartaric and citric acids decompose tartar emetic, but the new saline substances which are formed remain in solution in the liquor, and equally produce vomiting. One may add to an emetic water, syrup of lemons, or currants, without destroying its emetic virtue. If, during the action of an emetic, currant water or lemonade be drunk, it weakens the irritation which the emetic has established upon the gastric and intestinal surface.

Emetics and Narcotics.—Emetic medicines are frequently combined with opium, as the Dover's powder, laudanum in a solution of tartar emetic, &c.; but here the emetic is not generally in sufficient quantity to vomit.

Emetics with Purgatives.—This is a very common and useful combination. One or two grains of tartar emetic with one or two drachms of sulphate of soda or sulphate of magnesia, in four cups of water, or ten or

twelve grains of ipecac in a cup of infusion of senna, &c. These are called *emetico-cathartics*, and generally operate both ways. The effect of an emetico-cathartic is always mild, as it usually consists only of half a dose of emetic and half a dose of purgative. Most commonly it causes two or three vomitings and two or three stools. The irritation which it causes in the alimentary canal is always mild, moderate, and transient. This combination is beneficial when you wish to irritate mildly the digestive passages, and to obtain at once, without wearying the patient, evacuations up and down. They are not to be used where simple vomiting is your object, as in cases of poisoning, &c.

PURGATIVES.

Purgatives with Tonics.—If, in combining these together, the purgative is in sufficient quantity to act promptly and freely, it counteracts the effect of the tonic. On the contrary, if it be added only in small proportions, the tonic may produce its effect independently of the moderate purgation. Many celebrated physicians have recommended the combination of Rhubarb, &c., with the Peruvian bark.

In the joint operation of a purgative and a tonic the latter increases astonishingly the energy of the former. On this account it is recommended to diminish the dose of the cathartic substance, where it is united with a tonic—as this last by strengthening the tissue of the intestines, by developing their tonicity, renders them more sensible to the action of the purgative. This is verified in the mixture of powder, jalap, scammony, &c., with powder of gentian, elecampane, cinchona, red roses, &c. The same thing happens when the leaves of senna are put in a decoction of the root of the wild dock, of the dandelion, the wild endive, the fumitory, &c. The quantity of the syrup of buckthorn which is necessary to make powder of cinchona into an electuary, is sufficient to give it the purgative property which it possesses; and the lozenges, in which the principles of bark and those of senna and rhubarb are united, produce usually abundant evacuations.

Purgatives with Carminatives.—Excitants increase much more even than tonics the activity of purgatives. They stimulate the tissue of the intestines and develope the vitality, and thus the purgative principles cause an impression more deep and strong upon a surface more sensible and irritable. The purge acts with unaccustomed celerity; the evacuations are more frequent, and necessarily they are not preceded by that nausea which accompanies the pure purgations. The ancients were much in the habit of combining them—such as anise seed with decoction of senna—powder of ginger with turpeth mineral, and fennel with scammony, &c.

Purgatives with Diffusible Stimulants.—The wines, tinctures, and ethers

of various purgatives are illustrations. In using these, the two properties are very evident, and it is easy to perceive that their operation is not simultaneous but developed successively. Thus the stomach and intestinal canal are first excited, and some time after this, the ordinary symptoms of purgation show themselves. The effect of this compound differs according to the relative proportions of the ingredients. If the purgative principle be small, then the stimulant effects are very marked and continue long. If the menstruum be small, on the contrary, then the stimulant effect is transitory and disappears with the purging.

Purgatives with Demulcents.—Emollients relax the living tissues, weaken their tonicity, and, therefore, diminish the power of purgative agents. Broths, ptisans, &c., taken before or during the operation of a purge have the effect of moderating the violence of its operation. Manna, cassia, gummy substances, &c., which are united with purgatives before they are administered, serve as correctives of the purgatives. These additions are not proper when the object is only to cause intestinal irritation or a general action in the system.

Purgatives with Acidulous Substances.—The action of acids tends always to repress the impression of purgative substances when they become too strong or profound. Lemon juice or orange juice added to a decoction of senna leaves, or to that of rhubarb, or lemonade or currant water drunk after the administration of the purgative medicines, always fulfils this indication. Tamarinds, cream of tartar, produce no other effect when added to jalap, scammony, &c. It is easy to perceive that by moderating the too great irritation which purgatives excite in the alimentary canal, acids may favor intestinal exhalation and secretion, and thus render the evacuations more free and abundant. But they are not proper when the object is to excite a considerable irritation in the intestines—to cause revulsion or to excite the whole system.

Purgatives with Narcotics.—Opium counteracts purging. It may, therefore, be used to counteract too violent purgation. If it be combined in a purgative, the dose must be increased to produce the effect. Sydenham used to give a small quantity of opium previous to a purgative in cases where the sensibility was too lively or where he feared the purgative might produce too much excitement. Frequently physicians give at night an opiate to those who are to be purged in the morning.

NARCOTICS.

Narcotics with Tonics.—The effect of this combination differs of course according to the relative proportions of each in the compound. If the quantity of narcotic is large, then the compound will have to be given in such small doses as that the tonic can have but little effect. If the opium

is in small quantity then the effects of both tonic and narcotic are produced. The *Diascordium* is an example of this. In ʒss. of this electuary there is not more than $\frac{1}{6}$th of a gr. of opium, the rest being composed of tonic substances. Hence the tonic effect predominates. It produces a tonic and calming effect, useful in affections of the bowels, diarrhœa, &c.

When the great susceptibility of the stomach or intestines does not enable them to bear tonics, opium in the form of laudanum may be added to moderate this susceptibility. This is often necessary in intermittent fever to enable the patient to retain the cinchona either in electuary or enema. It is necessary, however, here to distinguish between nervous irritability and phlogosis of the stomach.

Narcotics with Stimulants.—Here, too, the character of the compound is determined by the relative proportions of the ingredients. Those compounds in which opium predominates can be given only in small doses—such is the condition of canella, cloves, &c., in the wine of opium or laudanum. In 15 gtt. or more of this, the excitant articles do not exhibit any of their peculiar property.

In the Isle of France, the old gastronomes take after every repast one or two large pastilles which are composed of opium and a number of stimulant articles, cloves, mace, nutmeg, and musk. As the opium is in small quantity it does not render the stomach torpid—on the contrary the combination excites its action and promotes digestion.

Narcotics with Diffusible Stimulants.—Wine, alcohol, and ether may be united with opium without causing any chemical change in either. Here both properties are preserved and their effects are produced, not simultaneously, but successively—the diffusible first and then the opiate. Potions in which ether or alcohol is added to laudanum, or other opiates, are in frequent use. Barbier thinks the Nepenthe of Homer was a combination of this kind, opium in wine. See vol. iii. p. 6.

Narcotics with Emollients.—Opiates added to gruel, marsh mallows, &c. &c., are instances of this. They are good in intestinal irritation, colics, diarrhœa, &c. This combination produces another effect. The debilitating influence of the compound upon the gastric organ hinders the chymification of the mucilaginous matters—prevents their absorption.

Narcotics with Acids.—The use of an acid favors the absorption of the opium by favoring its complete solution; but when the system is under the influence of opium, the acid seems to moderate its effects.

[These aphorisms from Barbier were, I believe, used by Dr. B. as texts for extemporaneous remarks. They seem to me to contain so much practical good sense that I retain them.—Ed.]

PROXIMATE PRINCIPLES.

Before entering upon the consideration of particular medicines, I shall make a few remarks concerning the chemical composition of organic substances. Upon this department an immense amount of learned labor has been expended, and it is proper that you should be acquainted with the results of it. With what are called the *proximate principles*, it is especially necessary that you should be familiar, inasmuch as a knowledge of them will greatly facilitate your inquiries in relation to the properties of the different individual articles of the Materia Medica that I may have occasion to notice. An account of them enters into the history of all medicinal plants, and their investigation serves to throw much light, not merely upon their chemical and pharmaceutical relations, but has, in many instances, proved the means of discovering some of the most active medicinal agents at present in our possession. I must content myself, however, with an outline of this subject, referring you for details to the various chemical works which have been recently published.

Organic substances, whether derived directly from the vegetable or animal kingdom, or produced by the various processes of art, are remarkable for their great complexity of constitution, while their *ultimate elements* are comparatively few in number. Instead of the sixty or more constituents of inorganic compounds, a few only, as oxygen, hydrogen, carbon, nitrogen, and occasionally sulphur, phosphorus, and two or three others, enter into the composition of vegetable and animal products.

The combination of a certain number of these few elements, under varying conditions, in various proportions, gives rise to a great variety of products, which are called *proximate principles*. Thus, *oxalic acid* is a proximate principle found in the *Oxalis acetosella, L.*, and in other plants, which by analysis may be resolved into its elements, carbon and hydrogen. *Sugar* is constituted of carbon, hydrogen, and oxygen. And *morphine*, one of the proximate principles of opium, consists of carbon, hydrogen, oxygen, and nitrogen, which are its ultimate elements.

I have already stated that, notwithstanding the simplicity of composition which characterizes organic substances, they exhibit much greater complexity than the products of the mineral kingdom. If the latter, the

combination can generally be represented by what may be termed the *binary* arrangement. Thus, oxide of copper is composed of copper and oxygen, potash of potassium and oxygen, sulphuric acid of sulphur and oxygen; while sulphuric acid unites both with oxide of copper and oxide of potassium.

But the products of organization are, with a few exceptions of a *ternary*, or *quaternary*, or even yet more complex character. Their atoms unite in groups, namely, 2, 3, 4, 6, 8, 10 or more atoms of one element, with any number of atoms of the other elements. Thus, an atom of morphine is formed of thirty-five atoms of carbon, twenty of hydrogen, six of oxygen, and one of nitrogen. Albumen has been represented by the formula of four hundred atoms of carbon, three hundred and ten of hydrogen, one hundred and twenty of oxygen, fifty of nitrogen, two of sulphur, and one of phosphorus. These numerous atoms seem, as it were, to be bound up into a single whole, which can enter into combination with other substances, and be thence disengaged with properties unaltered.

Sometimes also the slightest changes in elementary composition give rise to new and different proximate principles. Thus succinic acid, obtained from amber, consists of four atoms of carbon, two atoms of hydrogen, and three atoms of oxygen. If one atom of oxygen is added to this, we have the constitution of *malic acid*. If one more atom of oxygen is added, that of *tartaric acid*. And by adding yet another atom of oxygen, that of *formic acid*.

Again, sugar, starch, and wood have precisely the same constitution, namely, six atoms of carbon, five atoms of hydrogen, and five atoms of oxygen; they are *isomeric* (from the Greek, ἴσος, *equal*, and μερος, *a part*). Cases of this kind are very common among organic substances, and they seem usually to depend upon peculiarities of atomic arrangement.

From these peculiarities in the constitution of organic bodies, they have a very unstable character—are very liable to spontaneous decomposition—are decomposed by a red heat, and nearly all of them are partially changed by a temperature far below ignition.

The proximate analysis of organic bodies varies considerably with the nature of the substance to be separated, and some of these will be hereafter noticed. The ultimate or elementary analysis consists in the decomposition of the body by heat, in contact with some other substance. The mode now generally adopted is, to burn the matter to be analysed by means of oxide of copper (obtained by the decomposition of the nitrate of copper), so as to convert its carbon into carbonic acid, and its hydrogen into water, both of which are collected and weighed, and the proportion of each of the above elements atomically determined, the oxygen being estimated by difference. When the matter contains nitrogen, it is collected in the form of gas, or it is converted into ammonia, by mingling the substance with a mixture of hydrate of lime and caustic soda, and subjecting

the whole to a red heat. There are, however, several precautions necessary to the success of these processes, for an account of which I must refer you to standard chemical works.

Although most of the proximate principles employed in the Materia Medica are derived from the vegetable kingdom, a few of those obtained from animal products have been recently introduced. And as the remarks already made apply to organic bodies generally, I shall briefly notice some of the more important proximate principles without arranging them under distinct heads indicating their source.

The following will, I think, be found to be a convenient classification of these proximate principles.

I. Organic acids and their compounds, with bases.
II. Organic alkalies and the substances allied to them.
III. Oleaginous, resinous, and bituminous principles.
IV. Alcoholic and ethereal principles.
V. Sugars and their congeners.

I.—ORGANIC ACIDS.

These acids are characterized by having, with an exception of two, a sour taste, changing the blue of litmus, but more especially by their power of combining with salifiable bases. Like all organic principles, they are decomposed by a red heat; though they are in general less liable to spontaneous decomposition than most other organic products.

Some of the organic acids are the products of nature alone; some are the productions of nature and of art; and some are exclusively the products of art.

Among the more important of these bodies are the following.

Acetic Acid.—This acid exists in the sap of almost all plants, either free or combined with potassa or lime, and is also abundantly the product of art. In a concentrated form, it is most advantageously prepared by the decomposition of the acetate of soda by sulphuric acid and subsequent distillation. It may also be obtained by the distillation of common *vinegar*, which is prepared by exposing malt or vinous liquors to the free access of atmospheric air, at a temperature slightly elevated. When this acid is combined with bases it forms a class of salts called *Acetates*.

What is termed *Pyroligneous acid*, is an impure acetic acid prepared by the distillation of wood. When first made, it is of a dark color, holding in solution a portion of tar and volatile oil, from which, however, it may be freed by subsequent processes.

When metallic acetates in an anhydrous state are subjected to destructive distillation, they yield among other products, an inflammable volatile

substance called *Acetone* or *Pyro-acetic Spirit.* When pure, it is a colorless, limpid liquid, having an empyreumatic odor and a disagreeable taste. It burns with a bright flame, and mixes in all proportions with water, alcohol, and ether. By the action of acids it undergoes a variety of changes.

BENZOIC ACID.—This is the *Flowers of Benzoin* of the shops, a name which it has received from having been originally obtained from the Gum Benzoin, the produce of the *Styrax benzoin* (*Dryand.*). It exists also in the Balsams of Peru and Tolu, and several aromatic plants. It may be obtained in a state of purity by gently heating gum benzoin in a shallow iron vessel with a cone of paper placed over a paper diaphragm pierced with pinholes (Mohr's subliming apparatus). It occurs in white acicular crystals of a satiny appearance; has an aromatic rather than a sour taste, though it reddens litmus. It combines with bases and forms a class of salts called *Benzoates.*

CITRIC ACID.—This acid exists in great quantity in the juice of limes and lemons; it is found in many other fruits, as in gooseberries, currants, &c., in conjunction with another acid, the malic. It occurs, when pure, in the form of large transparent crystals, which have a pure and agreeable acid taste. It reddens litmus powerfully, is freely soluble in both hot and cold water, and combines with bases forming a class of salts called *Citrates.*

GALLIC ACID.—This acid is found in various plants, but is usually obtained from the *gall nut.* When pure, it is in the form of small, feathery, and nearly colorless crystals, which have a fine silky lustre. Its taste is slightly acid and styptic; it is soluble in 100 parts of cold, and in three parts of boiling water. Gallic acid does not precipitate gelatin, by which it is distinguished from tannic acid, with which it is often associated. With a proto-salt of iron no change is produced, but with a per-salt a deep bluish black precipitate falls, which disappears when the liquid is heated, from the reduction of the peroxide of iron to the protoxide at the expense of the gallic acid. With bases this acid forms *Gallates.*

KINIC ACID.—This acid, sometimes called also *Cinchonic acid*, is found in Peruvian bark combined with the alkalies. It may be obtained by decomposing the kinate of lime by the addition of the proper quantity of sulphuric acid. The resulting sulphate of lime being separated by filtration, the kinic acid is deposited in the form of small needles, soluble in two and a half parts of water at 68°, and also in alcohol. It has a sour taste without any bitterness, and forms salts called *Kinates*, which are mostly soluble in water.

LACTIC ACID.—This is the result of the fermentation of milk. It may

also be extracted from a great variety of liquids containing decomposing organic matter, as *sauer kraut*, a preparation of white cabbage, the sour liquor of the starch-maker, &c. In the purest form in which it can be obtained, it is a syrupy, colorless liquid, having an intensely sour taste and acid reaction. With bases it forms *Lactates*.

Malic Acid.—This is the acid of apples, pears, grapes, and most acidulous fruits; it is often associated with citric and tartaric acids, from which it may be distinguished by not giving any precipitate with lime water either by heat or when cold. It is white, difficultly crystallizable, slightly deliquescent, and it is soluble in water and alcohol. It has a sour taste, and with bases, forms *Malates*.

Meconic Acid.—This acid is found in opium, and when pure, crystallizes in small, colorless, pearly scales, which are soluble in four parts of boiling water and also in alcohol. It has an acid taste and reaction, and with bases forms *Meconates*. The most remarkable feature of this substance is its property of striking a deep blood red color with a salt of the peroxide of iron.

Oxalic Acid.—This acid occurs in the juice of several plants, especially in that of the *Rumex acetosa*, *L.*, or common sorrel, the *Oxalis acetosella*, *L.*, or wood sorrel, and in the varieties of *Rhubarb*. It is usually in combination with potash as an acid salt or with lime. It is also the produce of art, and is now manufactured in large quantities by the action of nitric acid on sugar, starch, and dextrine. It crystallizes in slender, colorless, transparent crystals, which dissolve in eight parts of water at 60°, and in their own weight or less of hot water. The aqueous solution has an intensely sour taste, a powerful acid reaction, and is highly poisonous. Oxalic acid, when heated with sulphuric acid, yields carbonic oxide and carbonic acid. With bases it forms *Oxalates*.

Prussic Acid.—This acid, also known by the name of *hydrocyanic acid*, is remarkable for its poisonous properties. It exists in the bitter almond, the kernels of plums and peaches, the leaves of the cherry-laurel, and in several other plants. It is also largely obtained by processes of art from various animal matters. When obtained in a pure form, by the decomposition of the cyanide of mercury, it is a thin, colorless, and exceedingly volatile liquid, with a powerful odor, resembling that of peach blossoms, or bitter almond oil; it has a feeble, acid reaction, and mixes with water and alcohol in all proportions. In its anhydrous form, it is one of the most deadly poisons known, and even when largely diluted with water, its effects upon the animal system are very energetic. It combines with bases, forming salts which are called *prussiates* or *hydrocyanates*.

TANNIC ACID.—This acid, sometimes known by the name of *tannin*, exists in the bark of various species of *quercus*, and many other trees; and in *gall nuts*, from which it is procured in the greatest quantity. In the purest form in which it can be obtained, it occurs as a slightly yellowish, friable, porous mass, without any tendency to crystallization. It is very soluble in water, less so in alcohol, and very slightly in ether. It reddens litmus, has a pure astringent taste, without any bitterness, and with bases forms *tannates*.

Tannic acid is often associated with, and mistaken for, gallic acid. The proto-salts of iron are not altered by tannic acid, but in the per-salts it occasions a dark blue precipitate; it is the basis of writing ink. It also precipitates animal gelatin, forming a yellowish, viscid, elastic mass, called *tanno-gelatin*, which is the essential basis of leather.

TARTARIC ACID.—This is the acid of grapes, of tamarinds, and several other fruits, being found in them sometimes free, but generally in combination with lime or potash. The tartaric acid of commerce is wholly prepared from the *tartar* or *argol*, an impure acid tartrate of potash, deposited from grape juice, in the act of fermentation. When pure, it occurs in transparent, often highly modified crystals, the primary form of which is a rhombic prism. It has a very sour taste, and reddens litmus powerfully; is soluble in both cold and hot water, and also in alcohol. The crystals undergo no change by exposure to the air, but its aqueous solution soon becomes covered with mould. It is a cheap substitute for citric acid in lemonade and effervescent solutions. With bases, it forms an important class of salts, called *tartrates*.

VALERIANIC ACID.—This acid exists in a variety of products, but has usually been obtained by the oxidation of an oil procured by distilling the root of the common valerian, *Valeriana officinalis*, *L.*, or by dropping the volatile oil of potato-brandy (*fusel oil*), slightly warmed, upon platinum black. In this case, the acid bears the same relation to the fusel oil, as acetic acid does to alcohol, or formic acid to wood spirit. It is a colorless, oily liquid, with the odor of valerian, and a sour, pungent, and nauseous taste. It dissolves in all proportions in alcohol and ether, and forms with bases a well characterized class of salts, called *valerianates*.

II.—ORGANIC ALKALIES, AND THE ALLIED SUBSTANCES.

Under this head are classed all those proximate principles which are capable of uniting with acids, and of forming with them saline compounds. The existence of this class of bodies was discovered in 1803, by Sertuerner, a German apothecary; but they excited no attention until about the year

1816, when he ascertained their true nature. Since that time, this department has been cultivated by several chemists, but especially by Robiquet, Pelletier, and Caventou.

The organic alkalies consist of carbon, hydrogen, oxygen, and nitrogen. They are all solid, of a white color, and mostly crystalline, when in a state of purity, usually inodorous, but having a bitter or acrid taste. They are not affected by exposure to air or light, but are in most instances decomposed by a moderate heat. They change vegetable blues to green. In water, they are nearly insoluble; in cold alcohol, sparingly soluble; but in boiling alcohol, readily so. From the hot alcoholic solution they are deposited, on cooling, generally in the crystalline form.

These substances are never found in nature in a free state, but appear in every case to be combined with an acid, forming a salt more or less soluble in water. The process for separating them, which is generally applicable, is, to digest or macerate the substance containing the alkali in water acidulated with muriatic acid, and to add to the filtered solution a more powerful salifiable base, as ammonia, lime, or magnesia. The organic alkali is thus separated from the acid, and, being insoluble in water, is precipitated. This precipitate, mixed with some animal charcoal, is then dissolved in boiling alcohol, and the solution filtered while hot and evaporated. The pure alkali is thus usually obtained, but sometimes the latter part of the process requires to be repeated.

I shall very briefly notice a few of the more important organic alkalies.

Morphine.—This is one of the alkalies found in opium, the inspissated juice of the *Papaver somniferum, L.* When crystallized from alcohol, it forms small but very brilliant prismatic crystals, which are transparent and colorless. Although it has a bitter taste, it is almost insoluble in cold water. It forms salts with acids, which are mostly soluble and crystallizable. This alkali, in powder, strikes a deep bluish color with neutral persalts of iron.

Narcotine is another alkali found in opium, and often associated with morphine. When pure, it is in the form of colorless prisms, which are tasteless and almost insoluble in water. It is distinguished from morphine by its solubility in ether.

Codeine, Thebaine, Narceine, Pseudomorphine, and Meconine, are the names given to other alkaline principles extracted from the very complex substance, opium.

Quinine.—This is the alkali of the Peruvian bark, in which it is associated with the kinic acid. It is in the form of white needle-form crystals, which have an intensely bitter taste, and are soluble in about 200 parts of

boiling water. With acids it forms salts, which are generally crystallizable. The *subsulphate of quinine* is manufactured on a large scale for medicinal use.

Cinchonine exists in large quantity in the *Cinchona condaminea, Humb.*, or pale bark, and is associated with quinine in all the species of the Peruvian barks. When pure, it crystallizes in small but brilliant prisms. It is but very feebly soluble in water, dissolves readily in boiling alcohol, and has but little taste. It unites with all acids, and forms a series of crystallizable salts.

When both the above bases are present in a sample of bark, they may be separated by converting them into sulphates. The salt of quinine is the least soluble of the two, and crystallizes first.

Quinoidine or *Chinoidine*, a substance obtained from the mother-liquor in the process for procuring sulphate of quinine, has been shown to be quinine in an amorphous state. It bears the same relation to ordinary quinine that uncrystallizable syrup does to crystalline sugar. In its purest form it occurs as a yellow or brown resin-like mass, insoluble in water—freely soluble in alcohol and ether. It is easily soluble, also, in dilute sulphuric acid, from which it may be precipitated by ammonia. The weight of this precipitate, when compared with that of the substance originally employed, affords the means of determining the purity of the sample.

Strychnine.—This is an alkaline body, of a highly poisonous nature, found in many species of *strychnos.* When obtained by evaporation from its alcoholic solution, it occurs in the form of small, white, four-sided prisms, or octahedrons. It is very sparingly soluble in water, dissolves in hot and somewhat dilute spirit, but neither in absolute alcohol nor ether. With acids, it forms colorless and crystallizable salts.

Brucine.—This is found in the bark of the *false Angostura*, now known to be the *Strychnos nux vomica, L.* It resembles strychnine in its properties, but is much less poisonous. When pure, it occurs in colorless rhombs, which are readily soluble in alcohol. With acids it forms salts which have a bitter taste and are generally crystallizable.

Emetine.—This is an alkali found in the root of the *Cephaelis ipecacuanha, Willd*, and *Viola Ipecacuanha, L.* When completely pure, it is white, uncrystallizable, nearly tasteless, but very poisonous. It neutralizes acids, but its salts are little disposed to crystallize.

Veratrine.—Found in the various species of *Veratrum*, and in the meadow saffron, *Colchicum autumnale, L.* It is white, pulverulent, inodorous, of an acrid taste, but without bitterness. It is insoluble in

water, but is soluble in alcohol and ether, has an alkaline reaction and neutralizes acids. Even in minute quantity it acts violently on the membrane of the nose.

Sanguinarine.—This is the active principle of the bloodroot, *Sanguinaria canadensis, L.* By the spontaneous evaporation of an alcoholic solution it may be obtained in masses which exhibit a crystalline structure; has no odor, but a taste bitter and afterwards acrid. It has an alkaline reaction and combines with acids, forming salts which have a beautiful *red* color.

There are also *Aconitine*, the active principle of the *Aconitum napellus, L.*, or monkshood; a very virulent poison; *Berbeerine*, an organic base found in the *Berbeera, Nectrandra rhodici* of Schomburgh; *Daturine*, a substance obtained from the seeds of the thorn apple, *Datura stramonium, L.; Nicotine*, a very poisonous alkaline principle obtained from the various species of tobacco, &c.

Substances somewhat allied to the preceding but not alkaline.—There are various substances somewhat allied to the preceding, but which do not give an alkaline reaction, nor combine with acids. The most important of these are, *colocyntin*, a bitter resinous matter extracted from colocynth; *gentianin*, obtained from *Gentiana lutea, L.*, or gentian, of a yellowish color, inodorous, but having the aromatic bitterness of the plant; *Piperin*, a white crystalline substance abstracted from black pepper; *Rhubarbarin*, the active principle of the rhubarb; *Salicin*, a white crystalline body obtained from the bark of the white willow, *Salix alba, L.*, having a bitter taste and resembling the sulphate of quinine; *Thein*, the active principle of tea and coffee, occurring in white, anhydrous crystals as the result of sublimation, &c.

III.—OLEAGINOUS, RESINOUS, AND BITUMINOUS PRINCIPLES.

Oils and Fats.—Oils are characterized by a peculiar unctuous feel, by inflammability, and by insolubility in water. The fats seem to differ from them principally in consistency.

The oils are divided into *fixed* and *volatile;* the former are comparatively fixed in the fire, and therefore, give a permanently greasy stain to paper; while the latter, owing to their volatility, produce a stain which disappears by gentle heat.

Fixed Oils and Fats.—These bodies in general have but feeble odor and scarcely any taste. They are all insoluble in water, and but slightly soluble in alcohol, with the exception of castor oil; in ether and the essential oils they dissolve in large quantity. By exposure to the air some of these oils become hard and resinous, while others thicken slightly, become rancid, but never solidify; hence they are distinguished by the terms *dry-*

ing and *non-drying* oils. To the first class belong the oils used in painting, as linseed, rape, poppyseed, and walnut; and to the second, olive and palm oils, and all the oils and fats of animal origin.

The consistency of these substances varies from that of the thinnest olive oil, to that of solid, compact suet; the difference being due to the variable proportions of solid and fluid fatty principles associated in the natural product. By means of a fixed alkali the oil or fat is decomposed into an acid which combines with the base, forming a true salt which is a *soap*, and a substance having a sweetish taste and which is soluble in water and alcohol, called *glycerin* (from γλυκυς, *sweet*). One of these acids formed during the process of saponification is called the *stearic acid*, the basis of which is *stearin* (from στεαρ, *tallow*), the solid semi-crystalline matter of fixed oils and fats. The other is termed *olein* (from ελαιον, *oil*), the principal constituent of the liquid oils and the liquid portions of fats, which is converted into *oleic acid* by combination with an alkali. In most fats also, and especially in that of the human body, another crystalline substance exists, called *margarin*, and which by combination with bases is converted into *glycerin* and *margaric acid*.

To the above property of the fixed oils it may be added, that, although insoluble in water, by trituration with sugar or gum they may be suspended in it, and they then form a class of preparations which in pharmacy are called *emulsions*. They also unite with the common metallic oxides, forming *varnishes* and *plasters*.

Among the more important of this class of substances are the following:

Olive Oil, expressed from the fleshy part of the fruit of the olive, *Olea europæa, L.*, cultivated in France, in Italy, in Spain, and on the coast of Africa. It has a fine greenish yellow color, slight odor, and agreeable taste. When pure, it has less tendency to change than almost any of the fat oils; but it is often adulterated with inferior oils.

Almond Oil, expressed from the kernel of the *Amygdalus communis, L.* It has a pale yellow color and a slight but agreeable taste. It is used in pharmacy for the preparation of emulsions; it soon becomes rancid when exposed to the air.

Rape Oil. A thick yellow oil expressed from the seeds of *Brassica rapa, L.*, and *Brassica napus, L.* It is much employed in France for burning in lamps.

Linseed Oil. The well known oil obtained by expression from the ripe seeds of the *common flax*, *Linum usitatissimum, L.*

Castor Oil. This is the *Oleum ricini* of pharmacy, obtained by expression from the seeds of the *Ricinus communis, L.* It is a thick, viscid oil, having a somewhat nauseous flavor, often nearly colorless, or only of a pale straw color. It differs from most of the class by its being soluble in all proportions in pure alcohol.

Croton Oil, a thick brownish oil expressed from the seeds of the *Croton*

tiglium, L. It has a peculiar odor, an acrid taste, and is violently purgative in doses not exceeding even one drop.

Palm Oil. This is the produce of various species of palm. It has the consistency of soft tallow or of butter, an orange yellow color, and a peculiar odor. It soon grows rancid; extensively used in the manufacture of soap and candles.

Among the animal fats and oils may be mentioned *mutton suet*, the fat of sheep, having a white color and little odor, when fresh, but acquiring a rancid smell when exposed for some time to the air; *beef fat*, the fat of oxen, of a yellowish white color, and requiring a heat of about 100° for its fusion; *hog's lard*, a white inodorous soft fat, the fusibility of which fluctuates between 80° and 88°; *human fat*, which is soft, yellowish, inodorous, solid at about 64°; *whale oil*, *spermaceti oil*, and the *cod liver oil*, or the oil obtained from the liver of the common cod fish, *Morrhua vulgaris*, which has lately been so much employed in medicine. Under this head, also, may perhaps be placed the different varieties of *butter* and *wax*.

Volatile or Essential Oils.—These oils are so named from their solubility in alcohol, such solutions being called *essences*, and from their volatility. It is in consequence of this last property that they are usually obtained by the distillation of the plants or parts of plants which contain them, with water. Some, however, are obtained by expression, as the *oils of lemon*, *orange*, and *bergamot*.

The essential oils have a penetrating odor and taste; are for the most part soluble in alcohol and very sparingly soluble in water. When pure, they pass into vapor at a temperature somewhat above 212°; but when distilled with water they pass over at its boiling point. They are very inflammable, and burn in the air with a clear white light. Their adulteration with the fixed oils can be determined by the greasy stain communicated to paper, not being removed by warming. A solid crystalline matter, corresponding to the margarine of the common oils, frequently separates from these bodies; it bears the general name of *Stearopten*, but is supposed to differ in almost every case.

Oil of Turpentine.—This is obtained by distilling with water, crude *turpentine*, which exudes from various pines and firs. The oil comes over with some resin, and is purified by a second distillation, when it forms the *essence* or *spirit of turpentine*. The pure oil is a thin, colorless liquid, having a peculiar odor. It is sparingly soluble in alcohol, and is so inflammable that it becomes dangerous when kept in large quantities. By contact with oil of vitriol it is changed into another liquid called *terebine*. With hydrochloric acid it forms a compound which has been called *artificial camphor*, from its resemblance in odor and appearance to that substance.

Oil of Lemon.—This is obtained both by expression and distillation from

the rind of the fruit. It has the same composition as the oil of turpentine, but differs from it in odor. The oils of *orange peel*, *bergamot*, *pepper*, *juniper*, *savin*, *laurel oil*, are also isomeric with the oils of turpentine and lemon.

Oil of Aniseed.—The oil distilled from the seeds of the *Pimpinella anisum*, *L.*, consists of two substances, one of which is a liquid oil, and the other a solid crystalline substance so abundant as to cause the whole to solidify at the temperature of 50°. The solid essence may be separated by pressure.

Camphor.—This is a concrete essential oil. It is obtained by distillation from the *Laurus camphora*, *L.* and several other plants. It is subsequently purified by sublimation, and is then a white, translucent, crystalline mass, which is difficult to powder, and having a powerful and very familiar odor. It is insoluble in water, but freely soluble in alcohol, from which it may be obtained in the form of brilliant crystals.

Resins and Balsams.—*Resins* are the inspissated juices of plants, and commonly occur either pure or in combination with an essential oil. They are solid at common temperatures, brittle, inodorous, and insipid; generally of a yellow color; some are transparent; soluble in alcohol, ether, and the essential oils; from the former, they are precipitated by water, in which they are quite insoluble.

The most important of these substances are common resin, or *rosin*, copal, lac, sandarach, mastich, and dragon's blood.

In pharmacy, resins melted with oil and wax, are used to make *plasters* and ointments.

Gum Resins.—These are the concrete juices of certain plants, and consist of resin, essential oil, gum, and extractive matter. The two former are soluble in alcohol, and the two latter in water. Their proper solvent, therefore, is proof spirit or a mixture of alcohol and water. Under this class are included several valuable medicinal agents, such as aloes, ammoniacum, assafœtida, euphorbium, galbanum, gamboge, myrrh, scammony, and guaiacum.

Balsams.—The balsams are native compounds of resin and benzoic acid, and issue from incisions made in the trees which contain them, in the same manner as the turpentine does from the fir. They are generally odorous and pungent. Some of them are liquid, as balsam copaiva and the balsam of Peru and Tolu; others are solid, such as storax and benzoin.

Caoutchouc, commonly called *elastic gum* or *India rubber*, is the produce of the *Siphonia elastica*, *Pers.*, a native of Brazil, and of several East India trees, which yield milky juice, hardening by exposure to the air.

In a pure state, it is nearly white, the dark color of the common caoutchouc being caused by smoke and other impurities. The most remarkable property of this substance is its elasticity. It is inflammable, and burns with a bright flame. In water and alcohol it is perfectly insoluble. The best solvents are petroleum, purified naphtha, oil of turpentine, coal oil, and especially the thin oily liquid obtained from the distillation of the caoutchouc itself. In a state of solution it is employed for forming varnishes, for covering cloth so as to render it water proof, &c.

A substance has lately been introduced under the name of *gutta percha*. It is the produce of a large tree growing in the mountains of Singapore, and in Borneo. Its general properties in regard to solvents, and to the produce of destructive distillation, resemble those of caoutchouc. At common temperatures it is hard and unyielding, but when immersed in boiling water it softens so that it can be moulded into any shape, and again hardens on cooling. It also possesses the remarkable property of contracting by heat, and is one of the best non-conductors of electricity. Gutta percha promises to be of great use in the arts.

IV.—ALCOHOLIC AND ETHEREAL PRINCIPLES.

Alcohol.—This principle does not exist ready formed in plants, but is the product of vinous fermentation, and is the intoxicating ingredient of all spirituous and vinous liquors. In its pure form it is a limpid, colorless liquid, having a penetrating odor and burning taste. The lightest that can be obtained by simple distillation has a specific gravity of 0·825, but by other processes it has been brought to the specific gravity of 0·793, at 60°. In that state it boils at 168°, and does not become solid even in the most intense cold. It is highly inflammable, burning with a pale bluish flame, and yields carbonic acid and water as the products of its combustion. It is remarkably expansible by heat; unites in all proportions with water, the combination being usually attended with a diminution of volume and an increase of temperature. The solvent powers of alcohol are very extensive, many salts, various organic bodies, as the alkalies, resins, essential oils, &c., being soluble in it.

Common alcohol, or *spirit of wine*, is prepared by distilling whiskey or some ardent spirit, and the rectified spirit of wine is procured by a second distillation. The first has a specific gravity of about 0·867, and the last of about 0·835 or 0·840.

Equal weights of absolute alcohol and water constitute *proof spirit*, the density of which is 0·917; but the proof spirit employed for tinctures has a specific gravity of 0·935 to 0·940. Tables are constructed, showing the specific gravities of various mixtures of alcohol and water.

Wine and other fermented liquors contain variable proportions of *ready formed* alcohol, to which they owe their intoxicating properties.

Ether.—This term is now applied to various compounds usually produced by the action of acids upon alcohol. These substances are characterized by their extreme volatility and inflammability.

Sulphuric ether is obtained by the application of heat to a mixture of equal weights of rectified spirit and oil of vitriol, and condensing the product. It is a colorless, transparent liquid, of a hot and pungent taste and fragrant odor. In its present form it has a specific gravity of about 0·720, at 60°, and is so very volatile that when a few drops are poured on the hand, the evaporation instantly causes a considerable reduction of temperature. It has for some years past been largely employed by the physicians on account of its *anæsthetic*, or pain-subduing property.

Nitrous or Hyponitrous ether, is procured by the action of hyponitrous acid vapor upon alcohol. It is a volatile liquid of a pale yellow color and an agreeable odor; specific gravity at 60°, 0·947.

The *sweet spirits of nitre* is prepared by distilling three pounds of alcohol with four ounces of nitric acid.

Hydrochloric ether, prepared by distilling a mixture of oil of vitriol, common salt, and alcohol, is a colorless liquid, having a pungent garlic odor, and a specific gravity of 0·874. To this may also be added *Hydrobromic ether*, *Hydriodic ether*, *Oxalic ether*, *Acetic ether*, *Butyric ether*, *Valerianic ether*, *Formic ether*, &c., all of which are liquids similarly obtained. The whole class seem to have a common base, to which the name of *ethyl* has been applied.

Chloroform.—This substance, which has recently attracted great attention in consequence of its remarkable anæsthetic property, seems to have been known as early as the year 1567. It may be obtained by distilling alcohol, wood spirit, or acetone, with a solution of chloride of lime. It is a thin, colorless liquid, of an agreeable ethereal odor and a sweetish taste. Its specific gravity is from 1·493 to 1·497. It is with difficulty kindled, and burns with a greenish flame. It is liable to several impurities, and is said to be decomposed under the influence of air and light, with the evolution of chlorine, hydrochloric acid, and formation of other products; but it does not seem to be altered when preserved under water.

V.—SUGARS AND THEIR CONGENERS.

Sugars.—There are several substances which are known to agree in having a sweet taste, but which differ in several other respects. Some of them when dissolved in water and mixed with yeast, undergo the alcoholic fermentation, while others are not susceptible of this change. To the former class belong cane sugar, grape sugar, starch sugar, milk sugar, mushroom sugar, &c.; to the latter, liquorice sugar and manna sugar.

Cane-sugar.—This is found in the juice of many plants, but is derived in large quantities from the sugar cane, the sugar maple, and the beet root.

From a strong solution of the purified syrup, large, transparent, colorless crystals of sugar may be obtained having the form of a modified oblique prism. It has a pure sweet taste, is soluble in water, melts when moderately heated and cools into a glassy amorphous mass, but at a higher temperature it blackens and is decomposed. When mixed with yeast it readily ferments, but the first action of the ferment seems to be the conversion of cane sugar into grape sugar, the only species which is supposed to be directly fermentable.

Grape Sugar.—This is the sweet principle of grapes, figs, and most acid fruits; it exists also in honey and is the sugar of diabetic urine. It may also be obtained artificially by the action of dilute acids upon several other substances, as cane sugar, starch, lignin, &c. It is neither so sweet nor so soluble in water as cane sugar, and in its mode of crystallization is moreover completely different.

Sugar of Milk exists in the liquid from which it derives its name, and occurs in the form of hard, white, translucent, four-sided prisms. Under particular circumstances it furnishes alcohol.

Manna Sugar is the chief component of *manna*, which exudes from various trees, especially from the ash, *Fraxinus ornus, L.; liquorice sugar*, a sweet unfermentable substance found in the root of the liquorice, *Glycyrrhiza glabra, L.*

Gum.—This principle is of very common occurrence in the vegetable kingdom. The most perfect type of the class is *gum arabic*, which is the hardened juice of various species of *Acacia*. It forms small transparent masses of a pale yellow color, which are inodorous and nearly tasteless. With water it forms a viscid, adhesive solution usually called *mucilage*, but the same term is also applied to a substance obtained from linseed, the roots of the mallow, &c., which differs in some respects from the preceding.

Gum Tragacanth is the produce of certain species of *Astragalus*. It is in the form of yellowish-white, transparent flakes, which do not dissolve in water, but when steeped in it swell into a mucilaginous mass. It contains a substance called *bassorine*.

Cherry Tree Gum and that of the *peach* and *apricot* trees, resemble inferior gum arabic in appearance, but are only partially soluble in water.

Lignin.—This is the substance which remains when wood has been successively treated by various agents, so that all the soluble matters are removed. When pure, it is destitute of smell, taste, and color; by hot nitric acid it is converted into oxalic acid, and by sulphuric acid changed into gum or dextrine, and at length into sugar.

Starch or Fecula.—This is one of the most important and widely diffused vegetable proximate principles, being found in a great number of

plants. It is most abundant in certain roots and tubers, as the potatoe, from which it may be obtained by rasping the substance, placing it upon a sieve, and washing it with cold water. The starch passes through with the liquid, and settles down from the latter as a white, insoluble powder, which may be washed with cold water and dried at a very gentle heat. From grain starch may be procured by mixing the meal with water to a dough, and then washing it upon a sieve or coarse linen cloth, and treating it as before. A yellowish white, tough substance remains behind, called *gluten*, to which the nutritious property of the meal is chiefly ascribed. This product differs from starch in containing nitrogen. By boiling alcohol the gluten is dissolved, while another principle, *vegetable albumen*, remains behind.

Starch is insoluble in cold water, alcohol, and ether. In boiling water it is soluble. The best test is the blue color which it forms with iodine. By being boiled in dilute sulphuric acid it is first changed into a body resembling gum, and then into starch or grape sugar.

Arrow Root, prepared from the root of the *Maranta arundinacea, L.*, has all the characters of pure starch. *Sago*, obtained from the pith of the *Cycas circinalis, L.*, and *Tapioca*, from the root of the *Jatropha manihot, L.*, are chemically the same substance.

Dextrine or *British gum* is prepared by heating dry potatoe-starch to about 400°. It is soluble in cold water.

I might here add notices of *animal albumen*, *fibrin*, and *casein*, which have been proved to be identical, or nearly so, with principles found in plants; but the history of these bodies is more intimately connected with the department of physiology, and I shall, therefore, not enter into a description of them.

EMETICS.

The term emetic literally means a substance which causes vomiting. Emetics have been accordingly defined to be those substances which excite vomiting. In its application, however, to the class of agents called emetics, this definition is altogether too comprehensive; various substances which are not emetics frequently produce vomiting. Thus, overloading the stomach with food, or swallowing something nauseous or irritating, may be followed by this effect. Emetics may, therefore, more correctly be defined to be those agents which by some peculiar or specific operation are capable of exciting vomiting.

As a class of medicinal agents, emetics have been in use from the earliest periods, and in their action they are of the most interesting character. Apparently simple, they nevertheless affect the system most profoundly, scarcely any organ or tissue escaping from their immediate or remote influence. Vomiting, although the most striking, is only one of the series of important effects which they produce; and to appreciate justly their uses and applications, it is necessary to understand thoroughly all these effects. It is the object of the following lecture to trace these effects as minutely as possible, with the view of establishing some general principles in relation to their uses in various diseases. In discussing this class of remedies, I shall notice

1. The organs immediately concerned in the act of vomiting.
2. The effects, local and general, which Emetics produce.
3. The circumstances modifying these effects.
4. The conditions of the system, favorable and unfavorable to their uses.
5. The different modes of introducing them into the system.
6. The rules to be observed in their administration.
7. The uses and applications of them in various diseases.

Of the organs immediately concerned in the act of vomiting.—These are the stomach, the duodenum, the liver, the gall-bladder, the pancreas, the diaphragm, and abdominal muscles. On the minute anatomy of these organs it is not my intention to enter. I propose only to notice such circumstances connected more particularly with the stomach, as may throw some light upon the operation of the agents under examination.

The *stomach* is a musculo-membraneous bag, generally compared in its shape to the pouch of a bagpipe; it is situated across the abdomen, directly below the diaphragm, partly in the left hypochondriac region and partly

in the epigastrium. It has two orifices—the cardiac, which connects it with the termination of the œsophagus; and the pyloric, which connects it with the duodenum. The stomach is made up of three different structures or coats —the serous or external coat, the mucous or internal lining, and the muscular, intermediate between the two; all three united together by cellular tissue. It is the two last which are more especially worthy of notice, in connexion with our subject. The muscular coat is not, as its name would indicate, a continuous membrane, but consists of separate strata of fibres, some of which are longitudinal, while others are circular. It is by this coat that the contractions of the stomach are caused, and from the peculiar distribution of the fibres in separate groups, this organ possesses the power not merely of contracting in all directions, but different portions of it contract and relax successively, and thus produce what is called its peristaltic or vermicular motion.

The mucous membrane is of a soft, velvet-like appearance, and has a pale red color. It has no power of contraction. When the muscular coat contracts, the mucous membrane is thrown into numerous folds or rugæ, chiefly longitudinal, which disappear entirely when the stomach is laid open and spread out. The mucous membrane has a great number of depressions, in which are found the minute openings of the glands which secrete the gastric juice. Muciparous glands abound in it.

As might naturally be inferred from the great importance of the stomach in the animal economy, it is very plentifully supplied with blood-vessels and nerves. Indeed there is scarcely any organ in the whole body more profusely supplied with them. Its nerves are numerous and various, being received from both the cerebral and ganglionic systems.

The Duodenum.—Of this organ it is only necessary to state that it is analogous in its structure to the stomach, except that it is not furnished with a distinct serous coat—it has a muscular and mucous covering. The mucous, being more extensive than the muscular, is thrown into transverse folds which are called valvulæ conniventes, and upon its inner surface are a number of mucous follicles. In the interior of the duodenum, about its middle, is a small tubercle, at the point of which are seen the orifices of the ductus communis choledochus, and the pancreatic duct. Sometimes these are united, and open by one orifice into the intestine.

Liver and Gall-bladder.—These organs communicate with the duodenum by means of the ductus communis choledochus, as already stated. This duct is made by the union of the hepatic and cystic ducts, and it is through these that the bile is conveyed from the liver and gall-bladder. The gall-bladder is so situated, that, when pressure is made upon the abdominal organs by the strong contraction of the abdominal muscles, its contents are more or less freely evacuated.

The Pancreas.—This organ also secretes a fluid which is poured into

the duodenum by the pancreatic duct. All these ducts have the same lining of mucous membrane as the stomach and duodenum.

EFFECTS OF EMETICS ON THE SYSTEM.

When an emetic is first taken, no immediate effect is produced. In about a quarter of an hour, sooner or later according to the article taken, state of the system, &c., an uneasy sensation begins to be experienced in the epigastric region, accompanied with nausea and slight dizziness. These sensations gradually increase—the pulse becomes small, frequent, and irregular—the face is pale and the surface chilly—the lower lip trembles, and saliva begins to flow;—convulsive contractions of the diaphragm and abdominal muscles now take place, which are shortly succeeded by actual vomiting. During the time that vomiting is going on, the face becomes flushed and turgid with blood, the pulse increases in fulness and strength, there is a glow on the surface, and the whole system, nervous, vascular, and muscular, experiences a general agitation. As soon as the vomiting ceases, the nausea goes off, and the system is left in a state of languor, accompanied with moisture on the surface and a disposition to sleep. By an ordinary emetic, the process of vomiting is generally excited three or four times, at short intervals. After the operation of the emetic is completed, the pulse will be found slow and feeble, and there will be general relaxation of the system, showing itself particularly in the cerebral and muscular systems, the skin, and sometimes in the bowels. Accordingly, there will be a sense of languor, debility, and drowsiness; the skin will be cool and moist, and sometimes copious discharges from the bowels will take place.

Such are the ordinary visible effects of an emetic. For the purpose, however, of understanding more fully the important changes which are wrought by emetics upon particular organs, it will be necessary to go a little more into detail.

Of the Local Effects.—When an emetic is swallowed, it comes in immediate contact with the mucous membrane of the stomach, and upon this makes a peculiar impression, the first effect of which is to produce an increase of secretion from its exhalant vessels and mucous follicles. This is abundantly shown by the character of the evacuations which are thrown off from the stomach in the act of vomiting. The impression thus made differs greatly in degree, according to the nature of the article used, and more especially according to the dose in which it is given. Generally, where the doses are moderate, this primary impression is mild and transitory, merely promoting secretion. In some cases, however, especially where the doses have been larger, irritation and inflammation have been

the consequence. Tartar emetic, for example, not unfrequently produces these effects.

REMOTE EFFECTS.—*On the Brain and Nervous System.*—It is here that the first remote effect of emetics is felt. During the different stages, however, of their operation, it varies. Shortly after the substance is received into the stomach, the brain is affected: hence the sense of vertigo and debility which is experienced, indicating a diminution of general power in this organ. As soon as actual vomiting occurs, a general shock is given to the brain, and this is followed, after the process of vomiting is completed, by a state of impaired energy, with a tendency to sleep. Emetics, then, although during the act of vomiting they give a temporary impulse to the brain, are essentially debilitating to that organ, as well as to the whole nervous system.

On the Mucous System.—As already stated, the primary effect of emetics is to produce secretion from the mucous membrane of the stomach. This, however, is not limited to this organ, but is extended to other portions of the mucous system. The parts more particularly affected in this way are those lining the œsophagus, the mouth, the trachea, and the bronchial tubes, from all of which an increase of secretion takes place during the operation of an emetic. The evidences of this fact are strikingly seen in certain states of disease. Thus, for example, a dry, coated tongue not unfrequently becomes moist and clean; and from the mucous membrane of the lungs free secretion and expectoration take place. Not unfrequently the same effect is extended to the mucous membrane lining the intestinal canal, as is shown by the increased evacuations from the bowels. Other portions of the mucous membrane are, no doubt, simultaneously affected. The general effect, then, on this system is to produce a change of action, and an increase of secretion.

On the Vascular System.—When an emetic first begins to affect the stomach, previously, however, to vomiting, the blood retires from the surface of the body, while the internal organs are crowded with it. Hence it is that the skin at this period is cool and the face pale. In consequence, too, of the diminished energy of the heart, and the consequent inability of that organ to throw the blood into the extreme vessels, the pulse is frequent and small. As soon as actual vomiting comes on, a re-action in the whole vascular system takes place, and the blood is driven back again to the surface, and it is owing to this that the skin becomes warmer and the pulse fallen during this period. In addition to this, a great accumulation of blood about the head takes place during the act of vomiting, as is indicated by the flushed face and the beating of the large vessels. This is occasioned not by any increased determination to this organ, but by an interruption in the return of blood, resulting from the pressure made upon the descending cava, and from the impeded respi-

ration producing a temporary obstruction in the pulmonary circulation. After the emetic has completed its operation, and the system has recovered from the mechanical agitation connected with the process of vomiting, the circulation is left in a state of impaired energy, and the pulse will be found soft and diminished in frequency.

On the Glandular System.—Several of the more important glands are conspicuously affected during the operation of emetics. Thus the salivary glands, the liver, the pancreas, and the kidneys, are all excited into action, and increased secretion produced from them. With regard to the liver, it is not in every case, nor by every emetic, that it is thus excited; frequently, however, it is so very powerfully, and then large quantities of bile are discharged by vomiting. That such an effect is actually produced upon the liver, is proved both by the *nature* of the bile which is discharged, as well as by its *quantity*. At the same time the liver is excited to increased action, the gall-bladder is more or less emptied of the bile which it may happen to contain. This is mainly effected by the mechanical pressure made by the surrounding parts upon this organ during the act of vomiting. This will be noticed more fully when I come to speak of the character of the discharge produced by emetics.

Upon the Pancreas the same effect is produced as on the liver, and increased secretion takes place.

On the Respiratory System.—This is powerfully affected by the action of emetics, and in different ways. In the first place, secretion is increased from the mucous membrane of the lungs; in the second place, from the violent and successive contractions of the abdominal muscles, as well as from the general shock given to the pulmonary system in the act of vomiting, mucous accumulations are dislodged and expelled.

On the Absorbent System.—With regard to the effect of emetics on the absorbents, there is a difference in opinion. Some contend that they *quicken* the action of these vessels, and the fact adduced in support of it is the rapid disappearance of tumors under the use of emetics. The manner in which this takes place is thus explained. It appears to be a law of the animal economy that absorptiou goes on in the inverse ratio of the fulness of the blood-vessels. When the system is plethoric, absorption is much less active than in an opposite condition. Hence blood-letting and starvation promote absorption. Now emetics lower the force of the circulation, and just in proportion to the degree in which they produce this effect, do they appear to promote absorption. Hence it has been found that those emetics which cause the greatest degree of nausea are most effective in the removal of tumors.

On the Cutaneous System.—The effect of emetics on the skin varies during the different stages of their operation. During the nausea which precedes vomiting the skin is cool and pale; in the act of vomiting, it becomes warm and flushed; after the operation is completed, it is left soft,

moist, and relaxed. This is owing partly to the nausea which is caused, and partly to the powerful determination of the blood to the capillaries of the surface during the act of vomiting. What shows the agency of nausea in producing this effect is the fact, that those emetics which are attended with the most sickness, produce the greatest relaxation of the surface.

On the Muscular System.—During the act of vomiting violent muscular contraction is produced. This is succeeded, after the completion of the operation, by a diminution in the tone and energy of the whole muscular system. This is strikingly evinced in the languor, debility, and indisposition to motion which are present. This effect is always proportioned to the degree of nausea which is produced.

On the Urinary System.—The general effect of emetics is to increase the secretion of urine. Occasionally, however, actual *suppression of urine* takes place. Dr. Heberden relates a case of this kind occurring in a female, and Mr. Brande mentions another in which no urine was secreted for twenty-four hours after the vomiting.

With regard to the effects of emetics it is to be recollected that they differ considerably, according to the article which is used. Some operate with *great rapidity*, while others are *slower.* Some produce much more *nausea* than others, while some produce much greater *prostration* of system.

From the foregoing analysis, it is evident that the agency of emetics is of a complicated character. In their primary action, they impress the gastric tissue and promote secretion from it. During the acts of vomiting, they agitate and convulse the whole system. In their remote operation, they affect almost every organ and tissue of the body. They are remedies of great power and pervading influence. When, therefore, you are giving an emetic do not imagine that you are merely emptying a man's stomach: this, as already stated, is frequently the least important of their effects; but consider them in the light in which they have been represented.

OF THE VARIOUS CIRCUMSTANCES MODIFYING THE EFFECTS OF EMETICS.

(*a.*) *Of Age.*—As regards the mere mechanical act of vomiting, children perform it more easily than adults. The reasons of this are various. One is that the abdominal viscera in children have a much greater proportional volume and thus aid in making the compression of the stomach so essential to the act of vomiting. Another reason, and one which has but recently been investigated, is the difference in the shape of the stomach of the infant and the adult. For the elucidation of this most interesting fact we are indebted to Professor Schultz of Germany. By him it has been shown that the stomach of the child is peculiarly favorable to the expulsion of its con-

tents, and that as we advance in life to adult age, it undergoes an important change in its shape, by which its evacuation is rendered more and more difficult.*

Notwithstanding this facility of vomiting, it is to be recollected that the mucous membrane in children is much more delicate and sensitive to impressions and irritations than it is in more advanced periods of life. In consequence of this, as well as the general feebleness of their organization, they cannot so well sustain the effects of those emetics which powerfully debilitate the system. On this account, antimonial emetics are frequently hazardous to young children. Dr. Clarke states that "a quarter of a grain of tartrate of antimony in solution, has been known to excite a vomiting which has ended in the death of a young child, which before was in no danger."† Dr. Armstrong states that he has seen several cases in which delirium has resulted from the use of antimony in young children.‡ I have known a case occurring in this city in which the one-thirtieth part of a grain of tartar emetic, given to a child of one year old, laboring under croup, produced such severe and protracted vomiting and general prostration as to require stimulants to save life. Dr. Armstrong states that "it is a notorious fact that hooping cough is far more fatal in London than in the country; and I believe this arises from the very free use of antimonials in London."

Previous to the time of Sydenham, no other active emetics were known than those prepared from antimony, and the want of some other emetic both efficient and safe was a matter of regret with this great man. In speaking of the continued fever of 1661, '2, '3, and '4, he says, "it has often been a difficulty with me, when called to infants and children in a fever, and observing an emetic indicated, whereby they might have been preserved from danger, that I durst not give this infusion (crocus metallorum) for fear of a bad consequence."§

In old age, the effects of emetics are also considerably modified. Although, from the impaired sensibility of the mucous membrane of the stomach and bowels at this period of life, little danger is to be apprehended from any local irritation, yet active emetics, especially tartar emetic, not unfrequently produce great and even dangerous prostration. Besides this there is another circumstance which renders the use of these articles at this age exceedingly hazardous, and this is the tendency which there exists to congestions, more especially of the brain. In consequence of this, the mechanical act of vomiting may be followed by fatal results.

(*b.*) *Sex.*—As the constitution of females is less vigorous, and their nervous systems more excitable than those of males, as a general rule, they

* The British and Foreign Review, No. 4, p. 539.

† Clarke on the Diseases of Children, p. 33.

‡ Lectures, &c., by John Armstrong, M.D., p. 248.

§ P. 18.

will not bear such large doses of emetic medicines, nor will they bear so well the more debilitating articles of this class. Care and caution, therefore, are to be taken with regard to their quantity, as well as the character of the articles used. During pregnancy, emetics should be prescribed with great caution. During the advanced months particularly, they are remedies attended with a good deal of danger. From the distended condition of the abdominal muscles, the vomiting is ineffectual and painful, and not unfrequently followed by the premature expulsion of the fœtus. This, in fact, is one of the modes in which artificial abortion is attempted to be accomplished.

Meckel says, "the stomach is larger, shorter, and broader in the male—smaller, narrower, and longer in the female."—V. iii. p. 262.

Women have to vomit a good deal in pregnancy. Is not this a wise provision to facilitate the operation?

(*c.*) *Peculiar Constitution of Body.*—As a general rule, persons of robust constitutions, although they may not perform the mechanical act of vomiting with more ease than those which are delicate, yet do not suffer so much from the general prostrating effects of emetics, especially the more active ones. In the exhibition, therefore, of this class of agents, due allowance must be made for this circumstance. Cæteris paribus, fat persons are vomited with more facility than lean ones. Hence, when there is great wasting of the body, as in marasmus, it is frequently impossible to excite vomiting at all, or if excited, it is performed with great pain and effort. The reason is obviously, that the volume of the abdominal organs is so diminished, that they cannot make sufficient pressure upon the stomach to enable the process of vomiting to be performed.

(*d.*) *Mode of Life and Climate.*—These have a very powerful influence in modifying the effects of emetics, as well as of all other remedies. The general susceptibility of the system and the delicacy of the tissues, it is well known, depend very materially upon the occupation, dress, exposure to the atmosphere, food, &c. Now the stomach participates in this effort as much as any other part of the system, and accordingly those accustomed to laborious employments and a hard diet, and at the same time exposed to the invigorating influence of country air, require much more powerful agents to excite their stomachs than those living in ease and luxury, and subjected to all the enervating influences of a city life. The learned Zimmerman remarks, that "Boerhaave prescribed emetics, in Holland, which would have been too powerful for persons whose stomachs were not loaded with cheese, butter, and putrid fish. The people at Rome eat less than at Paris, and therefore they require vomits that are less active."*

Dr. Brown, of Newburgh, New York, informed me that he had noticed

* A Treatise on Experience in Physic. By John G. Zimmerman, M. D. vol i. p. 51.

a marked difference in the effects of emetics in the country and in the city; much larger doses of tartar emetic are required in the country.

Besides these general causes connected with the mode of life, there are others of a more special character, which exert a striking influence over the effects of the more active emetics. In persons whose nervous systems are undermined by excessive study, or more particularly by intemperance, tartar emetic, for example, will frequently produce the most prostrating and dangerous results.

(*e*.) *Frequent Repetition.*—The general law of the system in relation to medicinal impressions is, they become less and less in proportion as they are repeated. Accordingly larger doses are required to produce the same effect. This is notoriously the case with stimulants and narcotics. To this general law emetics form an exception. So far from becoming habituated to their use, the stomach becomes more and more irritable in proportion to the frequency of their repetition. Dr. Cullen states that he knew persons who had been so accustomed to excite vomiting in themselves, that the twentieth part of a grain of tartar emetic was sufficient to excite a convulsive action of the stomach.*

(*f*.) *Actual Condition of the System at the time.*—Of all the circumstances modifying the effects of emetics, this is the most important. The states of the system more particularly influencing the action of these agents, are an irritated or inflamed state of the stomach, and disorder of the brain and nervous system. When active irritation of the stomach exists, emetics invariably bring on painful, if not ungovernable, vomiting; a striking illustration of this we have in the gastritis which attends yellow fever.

In certain disordered conditions of the *Brain and Nervous System*, the stomach, instead of having an increased sensibility, can with difficulty be roused by the most powerful emetics. Striking illustrations of this are met with in *apoplexy*, and in cases where the *system is laboring under the effects of opium and other narcotics.* Maniacs, it has long been known, are peculiarly unsusceptible to the impression of ordinary emetics; so much so, that the milder emetics frequently produce no effect at all, notwithstanding they may be given in very large doses and be frequently repeated. Ipecacuanha, for instance, frequently fails altogether in producing emesis under these circumstances, and the only one which is efficacious is the tartarized antimony. This insensibility to the impression of emetics is particularly observable in old and chronic cases, and where a good deal of cerebral congestion is present.

Where no cerebral congestion or inflammatory action is present, the insane do not bear well the operation of powerful emetics. Dr. Ferriar states that he has seen a dangerous debility induced by the action of a single dose of tartar emetic operating as an emetic.

* Richrand's Physiology, Note, p. 29.

† Histories, &c., p. 101.

In cases of apoplexy, too, the stomach resists in a remarkable degree the operations of emetics. Under these circumstances, it is exceedingly difficult, and sometimes impossible, to excite vomiting. Cloquet relates the case of a person laboring under apoplexy, who received into his stomach upwards of forty grains of tartar emetic, without producing either nausea or vomiting. On dissection, besides the morbid state of the brain, extensive lesions were found in the alimentary canal which were attributed to the action of the tartar emetic.* Dr. Harrison relates a case of a patient laboring under *epilepsy*, to whom a large dose of *sulphate of zinc* was given unsuccessfully in producing vomiting, who died from the effects of the inflammation which it caused in the stomach.† These cases illustrate very strikingly the rashness and folly of striving to secure the operation of a medicine by increasing inordinately the dose, when the difficulty is in the state of the system. In cases where the system is under the influence of *opium*, or some other *narcotic*, the same difficulty of causing vomiting exists. This is continually seen in ordinary cases of poisoning by opium.

Fourteen grains of tartar emetic have been given to a person laboring under the stupor produced by an overdose of atropa belladonna, without causing vomiting.

Now, the explanation of these facts is perfectly simple, if we recollect the manner in which vomiting is produced. As already explained, vomiting depends upon the concurring actions of the stomach, diaphragm, and abdominal muscles. Unless the two last are brought into action, vomiting cannot take place, no matter how much the stomach itself may be stimulated. Now, the actions of the diaphragm and abdominal muscles depend upon the influence which they derive from the brain and spinal marrow. When the brain and spinal marrow, therefore, become paralysed from any such cause as apoplexy, an overdose of opium, and the like, the actions of the diaphragm and abdominal muscles cannot, as a matter of course, be exerted, and vomiting cannot take place. At the same time, the sensibility of the stomach may be so far preserved as to suffer all the consequences resulting from too large doses of the emetic acting as a mere local irritant. In this way it happened in some of the cases just noticed. Although vomiting could not be induced, yet local inflammation ensued sufficient to destroy life.

STATES OF THE SYSTEM FAVORABLE AND UNFAVORABLE TO THE EXHIBITION OF EMETICS.

As emetics produce very powerful effects, it is evident that they ought to be used with caution. It is important, therefore, to designate the par-

* Paris & Fonblanque's Medical Jurisprudence, v. ii. p. 280.

† Paris's Pharmacologia, p. 87.

ticular conditions of the system in which they may or may not be used with safety.

1. Whenever *general plethora* exists, emetics cannot be used with safety. The reason is obvious. During the convulsive operation of vomiting, congestions of blood about the head always take place. In the ordinary healthy condition of the vascular system, this is attended with no dangerous consequences. As soon as the vomiting is finished, an equal distribution of the blood throughout the body takes place. When, on the contrary, the blood-vessels are unusually distended, these congestions during the act of vomiting have been known to terminate in apoplexy, and thus prove fatal. In this state of things, therefore, emetics ought never to be administered.

2. Whenever great *determinations to the brain* already exist, emetics should be avoided, and for the reason just mentioned.

3. Whenever any *organic derangement of the vascular system* exists, emetics are dangerous remedies. In organic diseases of the heart, aneurisms, &c., they are never to be used. The reason is plain. During the act of vomiting, independently of the general agitation of the system, there is a violent convulsion of the whole vascular system—a rapid ebbing and flowing of the blood. Now, to sustain this commotion, it is requisite that the heart and blood-vessels should be in a healthy state. Any portion of them that may be enfeebled by organic disease is liable to be ruptured, and when this is the case with the heart or large vessels, must prove fatal.

4. *Whenever any great contraction of the muscles concerned in vomiting may prove injurious, emetics ought not to be used. Hernia, pregnancy, prolapsus uteri, &c.*, may be mentioned as illustrations. In all these cases, the pressure of the diaphragm and abdominal muscles upon the viscera of the abdomen during the act of vomiting does mischief. In hernia, it causes the still greater protrusion of the viscera, and in some cases may cause strangulation of it. In pregnancy, as before stated, the act of vomiting may bring on premature contractions of the uterus and thus cause miscarriage. This is particularly the ease in advanced stages of pregnancy, and in those who have had previous miscarriages.

5. *Whenever the mucous membrane of the stomach is in a state of inflammation*, emetics are improper. Under these circumstances, they have the effect of adding to the irritation of the stomach and keeping up protracted and frequently ungovernable vomiting.

6. *Whenever a state of extreme debility is present*, emetics are not to be used. The agitation occasioned during the paroxysm of vomiting, and the relaxation and prostration consequent upon this process, may prove exceedingly injurious, and in some cases even fatal.

Having thus pointed out the conditions of the system in which this class of remedies ought not to be used, there is no difficulty in defining the state of the system in which they may be safely resorted to, provided their

use be indicated. *If the organs of circulation be in a sound state—if the blood-vessels be not too full—if there be no determination of blood to the head—if the system be in such a state as to bear muscular convulsion without danger—if there be no active irritation of the stomach, and if there be a due degree of strength*, then these remedies may be safely used.

MODES OF ADMINISTERING EMETICS.

1. By the stomach, the almost universal mode, to which, however, there are exceptions, when we resort

2. To the skin. Emetic substances can be made to operate through the skin either by the Iatraleptic or Endermic method.

The vegetable emetics can be safely used in both these ways; but tartar emetic should never be used in either, on account of the very severe local irritation which it produces. Used endermically, it has produced gangrene of all the tissues of the skin, and that without inducing vomiting.

3. Injection into the veins. This, as before remarked, is attended with so much danger that its use is only justifiable in the most extreme circumstances, as where a patient is choking from food in the œsophagus, &c., &c. Under such circumstances vomiting has been induced and life saved by injecting tartar emetic into the veins.

RULES TO BE OBSERVED IN THE ADMINISTRATION OF EMETICS.

1. As a general rule, unless where the object is simply to evacuate the stomach, emetics should be taken fasting. Hence the best periods for their administration are early in the morning or late at night. In this condition of the stomach they act with greater certainty, from the fact, probably, of their coming in a more unmixed state in contact with the inner surface of that organ, and thus being more certainly and speedily absorbed. It is not to be understood from this, however, that the mechanical act of vomiting takes place with greater ease when the stomach is perfectly empty. On the contrary, from what has been already stated in relation to this process, it is evident that a certain degree of distension of the stomach must greatly facilitate the act of vomiting. This is a fact which has long been known and practised upon, although the reason of it may not have been understood. It was on this account that the ancients were in the habit of filling the stomach with food previously to vomiting, to assist the process. This, however, is objectionable on a variety of accounts. It loads the stomach for an unnecessary length of time, while it interferes with the action of the emetic substance upon it. The best plan is the one in common use with practitioners, viz. make the patient drink as freely as possible of some mild diluent drink as soon as the emetic begins to operate; diluents should not be taken till after one free emesis,

as they hurry on the vomiting, and it is partial. The best is chamomile tea.

2. As it is not safe to vomit in all conditions of the system, attend to this, especially to the blood-vessels. If your patient be plethoric, bleed first. It will prevent dangerous consequences to the brain, and at the same time secure more effectually the general relaxing effects.

3. As a general rule, keep your patient in bed. This is especially necessary where you wish the general effects of the remedy.

4. The temperature of the room should be attended to. Never give an emetic either in a very hot or a very cold room.

5. Make up your mind beforehand as to *the precise object you have in view in giving the remedy.* Is it merely to evacuate the stomach, or do you desire to affect the system at large? Select your emetic according as you desire to fulfil the one or the other indication.

6. In judging of the general effects of the remedy, do not refer to the amount vomited, but rather to the influence produced on the system.

7. It is most prudent to give emetics in divided doses, and continue the administration till the result is satisfactory.

8. Never give an emetic unless you are perfectly clear that it is necessary. Would that this last caution, in its application to all the active articles of the Materia Medica, could be impressed on the minds of all practitioners!

In relation to the effects of emetics, there are one or two other things to be noticed a little particularly: 1st, the mechanism of vomiting; 2d, the character of the discharges from the stomach.

1. *The Mechanism of Vomiting.*—On this subject three opinions have been advanced. First, That emesis was produced by the stomach alone. Second, That it resulted from the action of the diaphragm and abdominal muscles alone, the stomach being passive. Third, That it was the effect of the joint action of both the stomach and the abdominal muscles.

The two former opinions are now pretty generally abandoned, and all agree that emesis is the result of the joint action of the stomach, the diaphragm, and the abdominal muscles.

2. *Of the matters discharged by Vomiting.*—As there are different organs called into action by emetics, and as the secretions from these organs differ, so the discharges caused by the operation of this class of agents vary in their character. An acquaintance with these is important inasmuch as it is only in this way that it can be ascertained to what extent the emetic has produced its effect.

When an emetic begins to operate, the first discharges consist of whatever matters may be found in the stomach. After this, fluids of various kinds are brought up according to the organs specially acted on.

Sometimes the matter evacuated is entirely of a *serous or aqueous* character, showing an increased exhalation from the vessels of the stomach.

Sometimes it is of a *viscid, mucous* character. When this is the case it shows that the mucous follicles of these organs have been excited into action. Either of these discharges may take place in very great quantity.

At other times the matter discharged is *bilious.* Sometimes the bile is almost pure, but more generally it is mixed with other fluids in the stomach. In some cases the bile thus discharged may be nothing more than what is continually passing into the duodenum from the ducts; while in other cases there is an increased action in the liver itself, and an increased evacuation from the gall-bladder. That bile is actually secreted in greater quantity than natural during the operation of emetics, is evident from the quantity which is sometimes discharged being altogether greater than what is contained in the gall-bladder.

It has been supposed that the bile discharged by vomiting existed previously in the stomach itself. That in some cases this is so, is very possible. Generally, however, it appears to be brought into the stomach during the process of vomiting. What proves this conclusively is that the bile does not appear in the first discharges, but makes its appearance only after repeated vomitings.

As a general rule, when a person vomits speedily after taking an emetic, there is no bile discharged. This is owing to the impression of the emetic substance not having extended itself to the liver.

The matters just noticed as being ejected in consequence of the use of emetics, are those which are seen in the healthy state of the stomach and the other organs concerned. In morbid conditions of these organs a great variety of other fluids is thrown up. Sometimes they are black, resembling coffee grounds, at other times resembling the yolk of eggs. These are all to be considered as morbid secretions.

Before proceeding to the subject of the application of emetics to the cure of disease, I desire to say a few words on the various indications they are competent to fulfil and the various ways in which they prove curative.

1. *Indications to be fulfilled by an Emetic.*—These are—

(*a.*) The simple evacuation of the stomach—this is all we require in cases of overloaded stomach and of poisoning; the three qualities in any emetic substance which fit it for use under these circumstances are, that it should act promptly, with as little nausea as possible, and should leave behind but little prostration.

(*b.*) Emetics may be required to make an impression on the mucous membrane of the stomach and change its morbid condition, hence their use in dyspepsia. Ipecacuanha best fulfils this indication.

(*c.*) Emetics may be given to evacuate the trachea and bronchi, as in croup, bronchitis, &c.

(*d.*) They are sometimes used to obviate the habit of constipation.

(*e.*) By the shock they produce on the whole system they may interrupt paroxysmal diseases, as intermittent fevers.

(*f.*) They relieve congestions, especially of the abdominal viscera, hence their use in some forms of fever, attended by congested liver.

(*g.*) They produce general relaxing and debilitating effects on the system at large, lessen the action of the heart and arteries, promote respiration, and unlock the secretions generally. When this relaxation is extreme, as it often is where excessive nausea precedes the operation of the emetic, the muscles are rendered powerless, and hence the nauseating emetics are often used by surgeons to prepare the way for mechanical efforts to reduce luxations and return hernial tumors.

(*h.*) They promote absorption, and thus do good in hernia humoralis, &c.

Either of these indications emetics may fulfil; only be careful in their use to make up your mind decidedly which of these indications you desire, else will your practice be always empirical and uncertain.

Application of Emetics in the treatment of Diseases.—In treating of this part of the subject it is not my intention to notice every individual disease in which this class of medicines may be used. To do this would of itself occupy a volume. My object is, and to this I shall limit myself, to mention some of the more important classes of disease, with the view of illustrating not merely the effects of emetics but also the general principles which have been laid down concerning their use.

I. *Fevers.*—In no class of diseases perhaps have emetics been more generally or extensively used than in fevers. In every age and country, and in every form and variety of fever, have they been prescribed. Notwithstanding this, they are not remedies which can or ought to be used indiscriminately, and it depends entirely upon the character of the fever and the particular period of the disease at which they may be given, whether their exhibition will be attended by beneficial or injurious consequences. The general principles upon which they may be rendered available are obvious enough, and they are given with the two-fold view of obtaining the local effects which they produce upon the stomach and biliary organs, and the general effects on the circulation and the system at large. The general objects then for which emetics may be advantageously given in fevers, are the following :—

1. To evacuate the stomach and make an impression on its mucous membrane.
2. To excite the secretions of the liver.
3. To give a general shock to the nervous system.
4. To equalize the circulation.
5. To relax the surface.

Of these the two first are the essential indications to be fulfilled. The three last are mere consequences of the others, and can frequently be

better accomplished by other means. As a general rule, therefore, whenever it is desirable to make an impression upon the mucous membrane of the stomach, and to excite the biliary organs to secretion, emetics may be used with advantage. The preliminary question then to be settled is, what is the precise condition of the stomach and biliary organs which requires and will admit of this impression being made upon them. The answer to this is evident. If the symptoms of the fever indicate nothing more than a *functional* derangement of the stomach and liver, emetics may be given with safety, and frequently with general benefit. They clear the stomach of its vitiated secretions, excite a new action in the mucous membrane, and promote healthy secretions from it. Extending their action, they excite the torpid liver and cause a copious secretion of bile, and thus relieve a congested state of that organ. If, on the other hand, however, there should be present an active irritation or inflammation of the mucous membrane of the stomach or duodenum, emetics do harm. They excite painful vomitings, increase the irritability of the stomach, and aggravate the local inflammation. As fevers differ, however, greatly in their character and in different periods of the disease, and as the use of remedies must be modified accordingly, it will be necessary to notice the principal varieties of fever a little in detail.

(*a.*) *Intermittent Fever.*—From the earliest periods emetics have been resorted to in this form of fever. Galen and Celsus both speak of them as necessary to the cure, and since then they have been in common use with physicians in every part of the world. Their use, therefore, is sanctioned by long experience and concurring testimony. The same unanimity of opinion does not, however, prevail in relation to the precise period of the disease when they can be used with most advantage. As this is a point of practical importance, it is worthy of examination.

By some it has been recommended to administer emetics in the *cold stage.* The propriety of this was probably inferred from the effort which nature herself frequently makes to evacuate the stomach at this period, and if nothing more active than warm water be used under these circumstances to aid the vomiting, the practice is not merely unobjectionable, but salutary. It is to be recollected that during the cold stage the internal surfaces, like the skin, are in a state of constriction; now the effect of warm water plentifully taken, independently of any emetic effect which it may produce, is to relax these surfaces and to restore their secretions. In this way it aids most powerfully in equalizing the general circulation, and thus cuts short the cold stage. By the use of active emetics the same effect, however, is not produced. In discussing the subject of emetics generally, I have stated that, whenever any great congestion of the internal organs is present, the condition of the system is unfavorable to the exhibition of emetics, and I have endeavored to show that to put the system thus circumstanced under the convulsive operation of an emetic

was a practice attended with extreme hazard. Now, in the cold stage of fever all the large organs and blood-vessels are in a state of congestion, and it will accordingly be found that emetics given at this period frequently produce great anxiety and distress, without having the desired effect in cutting short the duration of the cold stage. On these accounts emetics are not remedies generally advisable in this stage of Intermittents, unless they are such articles as *warm water*, or *warm water impregnated with salt*, as recommended by Celsus. Notwithstanding all this, it cannot be denied that an emetic sometimes proves salutary in the cold stage. When the internal congestion is moderate, and the operation of the remedy is followed by a speedy and perfect re-action of the vascular system, it cuts short the cold stage at once. As a general remedy, however, it is objectionable.

By some, emetics have been prescribed during the *hot stage*. This practice, however, can hardly be defended upon rational principles. In this period of the paroxysm, there is great general excitement; the pulse is full and frequent—the skin is hot and dry—all the secretions are shut up, and headache is frequently present, indicating determination to the brain. Under these circumstances, as a general rule, it would be unsafe to subject a patient to the operation of a powerful emetic. By the convulsive agitation of the vomiting, the general excitement would be aggravated and the determination to the brain would be increased, without any possible good resulting. The great object now is to moderate excitement, and this can be accomplished much more effectually as well as safely by other means. Should, however, emetics be deemed advisable, they should always be premised by venesection, particularly when the head is much affected. Instead of giving full emetics, a better practice is to put the patient on the use of ipecac or tartar emetic, simply with the view of producing nausea, lessening the circulation, promoting perspiration, and in this way bringing on as rapidly as possible the sweating stage.

During the *sweating stage*, emetics are manifestly inadmissible. The fever has already come to a crisis, and the system is in a state of prostration. The effect of an emetic would be simply to add unnecessarily to the general debility, and therefore they should be avoided.

The period best suited for giving emetics is in the *intermission*, and just before the return of a paroxysm. This was the practice recommended by Sydenham. He says if given just before the paroxysm is expected, so that the operation of it may be completely over before the time of the paroxysm, it frequently puts a stop to it, and especially, he adds, if an opiate be given after the operation of the emetic is completed.* The advantages attending this period for giving emetics are obvious. In the

* The works of Thomas Sydenham, M.D., with Notes by Benjamin Rush, M.D., pp. 37, 420.

first place, no congestions or local embarrassments are now present, and therefore no hazard can be encountered from the convulsion of vomiting. In the second place, besides the effects of the remedy on the stomach and biliary organs, the shock given to the system by the mere act of vomiting has a tendency to break up the chain of morbid action and thus prevent the recurrence of the expected paroxysm. This, then, would seem to be decidedly the most appropriate period for giving emetics, provided it should be deemed advisable to use them at all. And the best articles that can be selected are *ipecacuanha and tartar emetic* combined in the proportion of about grs. xv. of the former and grs. ij. of the latter. In a majority of cases, however, emetics are by no means necessary, and every beneficial and desirable effect upon the stomach and liver can be obtained by the milder operation of a suitable cathartic. In some cases, the revolutionary impression of an emetic is absolutely essential before any progress can be made in effecting a cure. It seems not merely to break in upon the periodical character of the disease, but to prepare the system for the efficient operation of other remedies.

Before leaving the subject of intermittent fever, I cannot refrain from making a remark in relation to the practice of repeating emetics every few days, in case the fever proves obstinate. No possible good, but much positive harm may result from such practice. It injures the tone of the stomach—keeps up an injurious determination to the head—and counteracts in this way the effect of tonic agents. I have known cases thus treated to be protracted for months, yet they were afterwards promptly cured by the use of the blue pill and quinine; as a general rule, all the beneficial effects to be expected from emetics can be gained from using them once or twice.

(*b.*) *Remittent Fever.*—This disease presents itself in two different forms, viz.—that of the *simple remittent* and the *bilious remittent.* The latter is the form of fever prevalent in hot climates, and in the hot seasons at the South and West in this country. It is acute in its character, and frequently terminates fatally on the third or fifth day. Compared with this the former is a mild disease. Now, in both the varieties of remittent fever, certain symptoms are present which would seem to indicate the propriety of emesis—there are a loaded state of the tongue—disorder of the stomach—nausea and sometimes actual vomiting—together with a deranged state of the liver; and there is no doubt that it is for the correction of these symptoms that emetics have been so generally recommended. Plausible as the practice appears, experience has abundantly shown that it is liable to numerous exceptions. In the simple remittent there is no question but they are frequently remedies of value, and from the general mildness of the symptoms their use is attended with no danger. They evacuate the stomach—excite a new action in the mucous membrane—unload the liver and gall-bladder, and thus relieve congestion of these organs, at the same

time that by their secondary or general effects, they equalize the circulation and promote perspiration. The best period for their use is the early stage of the disease, and they then serve as valuable preliminary means to prepare the system for the subsequent action of other means. Notwithstanding all this, they are by no means essential remedies, and their beneficial effects upon the stomach and liver may be obtained by calomel and other cathartics. In some cases, too, they are decidedly objectionable, and especially when the irritability of the stomach is associated with anything like active inflammation of the mucous membrane of this organ. They then only serve to aggravate this inflammation and operate injuriously.

In the *Bilious remittent* of hot climates and seasons, the objections to the use of emetics are still more cogent. One of the prominent symptoms here is acute irritation of the stomach, and the effect of emetics is to increase this irritation and bring on irrestrainable vomiting. Dr. Cooke, of Lexington, in speaking of the use of emetics in our southern fevers, says that "although safe and useful in common fevers, in seasons in which the cause (of fever) is abundant and active, producing extensive sickness, the stomach is often so irritable that the vomiting cannot be stopped. In 1804 and 1823, many lives were lost manifestly from the violence of their operation."* Dr. Burnett in his account of the Mediterranean fever confirms the same fact. In most of the cases in which tartar emetic was given to produce vomiting, it produced injurious consequences by increasing the gastric irritability.† As a general rule, in this form of fever, emetics should be used with great reserve. If recourse is had to them in any case, ipecacuanha should have the decided preference over tartar emetic. There is another reason which renders the use of these agents hazardous, and that is the condition of the brain and other organs. These frequently are in a state of inflammation or congestion, and when this is the case, the effects of emetics are more than doubtful. I have known cases of remittent fever, in which, and from a peculiar partiality of the physician for emetics, these remedies were repeatedly given, which terminated in a few days fatally, mainly owing to the incessant determination to the brain kept up by the convulsion of vomiting.

Yellow Fever.—In this form of fever, emetics, although recommended by some, cannot, as a general rule, be used with safety. Whatever may be the theoretical notions entertained in relation to this disease, one thing is established both by the symptoms and by the dissection, and this is, that the stomach is the seat of acute inflammation. It is this which gives rise to that terrible symptom, black vomit, which generally terminates only with the life of the patient. If this be so, we should naturally infer that emetics would hurry on and aggravate this symptom; and such is proved

* Medical Recorder, vol. vii. p. 512.

† Johnson on Tropical Climates, vol. ii. p. 19.

to be the fact by experience, both in the West Indies and in this country. On this subject, Moseley uses the following impressive language: "How often have I seen and lamented the effects of tartar emetic, given to remove the supposed cause of the treacherous symptom of vomiting. Even in slight degrees of fever in the West Indies, in young plethoric subjects newly arrived, the stomach has been sometimes destroyed by it. Instead of removing the irritating sickness in this fever, or exciting a diaphoresis, a spasm has been produced in the stomach; incessant vomiting, inflammation; the vessels of the thorax and head have been stifled with blood; and the patient has vomited away his life. Nature's index here is misconceived. It is for assistance that she makes these struggles, showing that the part is suffering destruction. It is an indication that her oppressions are leaving her in that manner; for who ever saw or ever heard of a crisis from incessant vomiting?"*

(c.) *Continued Fevers.*—After what has been said in relation to the use of emetics in intermittent and remittent fevers, a few words will suffice in relation to their use in the continued forms of fever; as occasional remedies, and with due regard to the existing condition of the system, they may be used in all of them. The propriety of having recourse to them must be decided by the stage of the fever, the condition of the vascular system, the presence or absence of local inflammation or congestion, and the state of the stomach. The best period for their use is the early stage of the disease, where the various organs are in a state of oppression. Here they frequently prove most salutary, by restoring the secretions of the stomach and liver, as well as by the general reaction of the vascular system which they occasion. In this way, they frequently cut short the stage of oppression, and indeed the course of the whole subsequent fever. Should symptoms of great vascular excitement be present, emetics should never be used until this is reduced by venesection. When local inflammation or great local congestion exists, they should be used with the greatest caution, especially if the brain be the organ affected.

Having thus briefly noticed the use of emetics in fevers, the general conclusion, I think, may be safely drawn, that emetics are remedies which ought not to be used indiscriminately in fevers. Occasionally of great value and efficiency, they frequently do much harm. The best rule, perhaps, to be observed, is not to use them at all, unless there be some positive indication for it. Unless some decided benefit is anticipated from them, they ought to be abstained from.

II. *Inflammations.*—For the purpose of determining the use and value of emetics in this form of disease, it will be necessary to keep in view the general object to be attained in the management of inflammation. This,

* A Treatise on Tropical Diseases, &c. By Benjamin Moseley, M. D., p. 435. 3d ed. London.

of course, is to relieve the local embarrassment, and to lessen the general excitement which accompanies it. Whether emetics, then, co-operate in fulfilling this indication, is the problem to be solved. From what has previously been stated in relation to the changes which take place in the system during the process of vomiting, it is evident that the mere act of vomiting can be of no service. On the contrary, from the great shock given to the system, from the vascular and muscular agitation which it causes, it may have the effect of increasing pain, and still further crowding the inflamed capillary vessels, besides augmenting the general inflammatory fever. The mere act of vomiting, then, so far from being beneficial, may be exceedingly injurious.

The secondary effects of emetics are of a different character. They relax the system, equalize the circulation, and promote the various secretions—all favorable and important in the resolution of inflammation. If these effects could be secured, without the disadvantages of the first, there could be no question as to their utility. Here, then, we have two sets of effects united, opposed to each other; and it is this which renders the use of this class of remedies so variable and even contradictory. Nevertheless, they may frequently be used with certainty and advantage, and the circumstances under which they may be resorted to are the following:—

1. When the inflammation is moderate in degree. As a general rule, just in proportion to the violence of the inflammation which may be present, will the distress attending the convulsive operation of emetics be aggravated, while the relaxing effects will be inconsiderable and inefficient. When the inflammation is mild in its character, or when active depletion has been premised, emetics may frequently be used with benefit.

2. When the inflammation is seated in such a structure, as that the operation of emetics will cause copious secretions from the part, as it does in many inflammations of the mucous membrane, the local depletion which they cause, together with their general effects on the system, not merely counterbalance all the objectionable effects attending them, but render them exceedingly beneficial.

3. When inflammation is complicated with functional derangement of the stomach and biliary organs. In cases of this kind, whatever be the seat of inflammation, emetics may frequently prove useful by correcting the condition of these organs, and in this way aid in simplifying the character of the disease.

Having noticed the use of emetics in febrile and inflammatory affections, I shall next consider their application in some other diseases.

Diseases of the Head.—From the effects of emetics on the head as already detailed, it is evident that they are remedies which must be used with great caution in diseases of this part. Although valuable agents in

some cases, they frequently are not merely useless, but positively injurious. It is important, therefore, properly to discriminate between these cases. In all *active inflammations or congestions* of the brain, as a general rule, they ought not to be used. In the treatment of these conditions of the brain, the great object is to divert the flow of blood from this organ by every means in our power, and for this purpose we have recourse to all those agents which have a tendency to promote the flow of blood to other parts. From the effects of emetics in accumulating blood about the head, it is evident that they cannot be advisable in cases of this kind. Indeed, as a general rule, they necessarily aggravate the existing morbid condition of the brain. With regard to the use of emetics in *apoplexy*, great diversity of sentiment has existed. By some of the highest authorities in medicine they have been decidedly recommended—Sydenham, for example, advises an emetic to be given immediately after bleeding from the arm and jugular veins. Dr. Fothergill, too, recommends them. The majority of physicians, however, are opposed to them, and I think that there can be no question that they are agents which must generally prove injurious. There is one form of apoplexy, however, in which they may be used with advantage, and that is when the apoplectic seizure is occasioned by an overloaded stomach, as it sometimes is. In cases of this kind, after suitable depletion, emetics will be the most efficient agents in affording relief. Although, therefore, in active *inflammation and congestion* of the brain emetics are doubtful, yet there are other disordered conditions of this organ, in which they have been found exceedingly useful—of these mania, delirium tremens, and intermitting headache may serve as illustrations.

In mania, emetics may prove salutary in several ways. In the first place, in many cases of this disease there is present a torpid and deranged condition of the liver, stomach, and bowels. In many instances this condition is associated with the origin of the malady, while in others it may supervene as one of the effects of the primary disease. In either case it exercises a very powerful influence over the general course and severity of the disease. To correct this state of things is accordingly of great importance, and among the best remedies to begin with are emetics. By the impression which they make upon the mucous surfaces of the stomach, on the intestines, and the liver, and by the secretions which they cause from them, they relieve the congestion not merely of these but of the abdominal viscera. In this way they operate frequently indirectly in quieting the cerebral disturbance.

In the second place, emetics may prove beneficial by the general relaxing effects which they produce—tranquillizing the vascular system and promoting a more equal distribution of the blood.

In the third place, emetics sometimes prove salutary by the general

shock which they give to the brain and whole nervous system during their operation.

In either of these ways or by the combined effect of the whole, this class of remedies may prove in many cases exceedingly advantageous. In using them of course you are to bear steadily in mind the general precautions already laid down. If the head should be crowded with blood or if there should be great general plethora, they are to be abstained from until this is corrected. The kind of emetic which is to be used is important. The best is tartarized antimony, and in the form of solution. It acts most efficiently on the abdominal viscera, and at the same time possesses the advantage of being easily disguised, a circumstance of no small importance in the treatment of maniacs. With regard to the repetition of them, this must be determined entirely by the particular circumstances of the case.

Delirium Tremens.—Dr. Klapp of Philadelphia introduced the practice of giving emetics in this disease. He was led to try them from observing spontaneous vomiting appeared to arrest the disease. He and others have reported a large number of successful cases; but notwithstanding, I think the practice of giving emetics indiscriminately in this disease is *highly objectionable.* The whole nervous system is shattered, and active remedies cannot always be borne. Several cases have occurred in which tartar emetic has caused fatal prostration. Eberle reports two. I have seen one. Be very cautious in the use of any emetic in this disease, and especially avoid tartar emetic.

In *Hysteric Convulsions*, emetics are frequently the most efficient remedies that can be used, generally arresting the convulsions as soon as free vomiting is effected. Should the patient be full-blooded or should there be great determination to the head, it is advisable to draw blood from the arm. Generally, however, amid the struggles of the patient, this is a difficult operation, and the cases are very rare indeed in which an emetic may not safely be given at once. After the spasms are quieted, blood may then be drawn to an extent deemed advisable by the circumstances of the case. The best emetic that can be given in these cases is tartarized antimony. In solution, this can be given with greater ease than any other article, and causes also more general relaxation.

In the *convulsions to which children are subject*, emetics are no less serviceable than in those of which I have just spoken. Of course, I do not now allude to those convulsions which arise from organic affections of the brain, such as hydrocephalus and the like, but to the ordinary convulsions to which children are so liable, and which usually arise from dentition or from crude accumulations in the intestinal canal. In both cases, emetics of ipecacuanha will be found to operate with great efficacy in arresting the convulsion.

In *Epilepsy*, the use of emetics was recommended so far back as the

time of Aretæus. The practice, however, does not appear to have been a very popular one, and it is only recently that it has been revived. The principal causes of this curious disease may be referred to two general classes, viz. organic affections of the brain, and irritations existing in the digestive organs acting sympathetically on the brain. In epilepsy arising from the last of these causes, there can be no doubt of the propriety of the use of emetics, as they operate directly in removing the cause of the disease. Even in cases, however, where epilepsy arises from some disordered condition of the brain, emetics may frequently be used, not merely with safety, but advantage, provided great fulness of the brain be not present, in which case they would be improper until after depletion. In young patients subject to this disease, the use of emetics is frequently attended with the happiest effects. Very generally, in cases of this kind, occasional sickness at the stomach, flatulency, and other evidences of a deranged condition of the digestive organs, will be found; and under these circumstances an emetic of ipecacuanha and sulphate of zinc combined, repeated every three or four days, will be found a remedy of great value. Although not tried, so far as my knowledge extends, I would suggest whether some prospect of advantage is not held out by the use of emetics in those hitherto intractable diseases, *tetanus* and *hydrophobia*. The article which should be preferred in these cases is the tartar emetic, as most likely to produce a full relaxing and antispasmodic effect on the system. Many headaches depend upon some disordered condition of the digestive organs, and may be relieved by the use of emetics. In that species of it which is called intermitting, they will be found pre-eminently beneficial. This disease appears to be an intermittent in disguise, and requires to be treated upon precisely the same principles. In some cases, it may be cured by the simple use of antiperiodics, used as in intermittents. Cases, however, occur in which this does not answer until a full emetic has been given. It operates by two ways—by correcting any latent disorder of the digestive organs, and by giving a shock to the nervous system, by which the recurring morbid action is obviated.

Diseases of the Throat and Chest.—In a great number of these affections, emetics are remedies of inestimable value, and they operate beneficially in the following ways. 1. By promoting the secretions of mucous membrane of the larynx, trachea, and lungs. 2. By aiding expectoration. 3. By their general relaxing effects on the system.

In *Tonsilitis*, an emetic of tartarized antimony and ipecacuanha may frequently be given with great advantage. Where the patient is plethoric suitable depletion should be premised. In many cases every advantage may be obtained by putting the patient on a solution of tartar emetic with the view of causing nausea, without carrying it to the extent of actual vomiting.

In *Cynanche Maligna*, if given sufficiently early in the disease, they are remedies much to be relied on. They dislodge the morbid secretions accumulated about the fauces, change the action of the part, and have a tendency to restore the natural secretions. From the great prostration which ensues in this disease, they are remedies which should be used with due caution. In the advanced periods of it, emetics, if used at all, should never be of a debilitating character. Such articles should be selected as will vomit without producing much general prostration, as the sulphates of zinc and copper.

In the severest of all the forms of inflammation, I mean *Laryngitis*, emetics are among our most valuable resources. From the rapidity with which this disease frequently runs its course such remedies are indicated as will operate with the greatest promptness, and among these venesection and emetics take the lead. Bleeding to syncope in most cases is the remedy first to be applied. After this an emetic of tartarized antimony and ipecacuanha is the article best calculated to afford relief; and it does so, probably, by the copious secretions which it produces from the fauces as well as by its general relaxing effects on the system. The importance of this remedy has not, it appears to me, been sufficiently insisted upon by those who have treated of this formidable disease.

In *Bronchitis*, emetics are remedies of great utility, and they may be used with great freedom both in children and adults. In the early stage of the disease, they promote secretion from the inflamed membrane and produce general relaxation, while in the advanced periods they prove advantageous by expelling the superabundant secretion which is oppressing the lungs and interfering with the due performance of the function of respiration. In children, they are the only agents that we can resort to for relieving the lungs when oppressed by superabundant secretion. In adults, tartar emetic, and in infants, ipecacuanha or antimonial wine and squills, may be used.

Bronchitis is sometimes complicated with hepatic disorder, and in these cases emetics are doubly advantageous.

In *Pertussis* or hooping cough, emetics have been used from time immemorial, and their use has received the general sanction of professional experience. A slight reference to the principal phenomena attending this disease will show how they may prove beneficial. Whatever theories may be entertained in relation to the precise nature of this disease, it is certain that the mucous membrane of the larynx, trachea, and lungs is the principal seat of irritation, in consequence of which an incessant secretion of viscid matter is taking place from it. The irritation, however, is not confined to this part; other portions of the mucous membrane participate in it, and especially that which lines the digestive organs. The secretions of the stomach and bowels are disordered—they become torpid and lined

with viscid mucus. The liver too is congested and its secretions deranged. If such be the condition of things in the lungs, the stomach, liver, and bowels, it is easy to see how emetics may prove salutary. In the first place, they unload the stomach of viscid mucus and excite the torpid liver. Next, they act on the mucous lining of the larynx, trachea, and bronchial tubes, promoting secretion and causing the separation and expulsion of morbid matters accumulated upon it. Independently of all they prove salutary by their general revolutionary operation on the system, by determining to the surface and producing relaxation. Salutary as they are in this complaint, they are not to be used indiscriminately. Regard must be had to the actual condition of the system—the period of the disease—and the kind of emetic to be used.

In the commencement of the disease, when the digestive organs are in the condition described, an emetic should be given with the view of producing its full effects, and for this purpose a combination of tartar emetic and ipecacuanha is the best that can be used.

In using full emetics in this way there are some cautions which you are to observe.

1. To examine very carefully the evacuations which may be caused by emetics. Unless you do this, you can form no opinion at all of the effect of the remedy.

2. The use of full emetics ought not to be repeated too often. Although I approve highly of the use of these remedies, yet I think they have been much abused in this complaint, and the reason is because practitioners generally form no very distinct notion of the object they have in view in their use. From the incessant and long continued coughing in this complaint, it is to be recollected there is always more or less determination created to the brain. Now, the effect of vomiting, as is known, is also to determine to the brain, and between the coughing and vomiting, if repeated too often, it will frequently be found that irreparable mischief is done to the brain; and I think I have seen one case at least, in which the too free use of emetics laid the foundation for a subsequent attack of hydrocephalus, which terminated fatally. Caution is therefore necessary in the use of these articles. Even if you have no fears of this kind, always select mild articles if you design to repeat the emetics often; use ipecac rather than tartar emetic.

Phthisis Pulmonalis.—Emetics at one time enjoyed a much higher reputation in this disease than they do at present. That they may prove beneficial by their expectorant action on the bronchitis usually present in these cases at some period of the disease is possible. So, too, they may promote secretion, equalize circulation, and keep up a determination to the skin—all objects of great importance. But in using emetics in phthisis, it should always be recollected that one of the leading features of the disease

is great constitutional debility, and of course the use of a debilitating remedy like emetics should never be carried far, nor should such an article as tartar emetic be used at all.

In *Trachitis* or croup, emetics are remedies of acknowledged efficacy. In the different stages of this disease they are, however, to be used with different modifications and different objects. If the disorder be taken in its very commencement, before general inflammatory action has yet come on, there is no remedy so admirably calculated to break up the disease as emetics. A single emetic not unfrequently relieves at once the stricture under which the trachea is laboring, restores the secretions of the mucous membrane, and renders respiration free. The best article to be used is a combination of tartar emetic and ipecacuanha, or the hive syrup. In the more advanced stage of the disease, where inflammatory fever is set in, emetics are also to be used. Here they should be preceded by venesection, and the solution of tartarized antimony answers best. This should be used in doses sufficient to produce full vomiting, and afterwards continued so as to keep up nausea and relaxation. In the latter periods of the disease, emetics may still be resorted to with advantage, although for a somewhat different purpose. Inflammatory action has now subsided, effusion has now taken place in the trachea, and a membrane has been formed lining the canal which mechanically obstructs respiration. By the act of vomiting, this membrane may sometimes be detached and brought up. For this purpose such emetics are to be used as will vomit without adding to the general debility. The best are the sulphates of zinc and copper.

In *Pleuritis* and *Pneumonia*, emetics are remedies not generally applicable. It is only when they are complicated with bronchitic or hepatic symptoms that they can be used with any advantage.

Diseases of the Abdomen.—In many of these, emetics are remedies exceedingly useful. They operate, 1. By relieving the stomach of foreign matters and morbid secretions. 2. By changing the condition of the mucous membrane of the stomach and promoting its secretions. 3. By exciting the secretions of the liver. 4. By the concussion which they give to the abdominal viscera during the act of vomiting. 5. By their general relaxing effects on the system at large.

In all cases of *Poisons* taken into the stomach, whether mineral or vegetable, the first indication to be attended to is that of expelling the poison from the system. If the patient be seen soon after taking the poison, this can be done frequently by the administration of suitable emetics, as the object here is simply to evacuate the stomach; and to produce this effect as speedily as possible such emetics are to be selected as operate with the greatest rapidity, and at the same time are confined in

their effect, as much as possible, to the stomach. The best articles therefore, to accomplish these objects are mustard and the sulphate of zinc and copper. Some poisons act as local irritants, and they produce vomiting and purging. In these cases, simple dilution with tepid water will be sufficient.

In almost all *disordered states of the stomach*, the use of emetics would naturally suggest itself, and they have been accordingly extensively used. Experience, however, has shown that they cannot be used indiscriminately, proving salutary or noxious according to circumstances. As a general rule, when inflammation of the mucous membrane of the stomach, whether acute or chronic, is present, they are remedies which ought to be used with caution. If they should be considered necessary, the mildest articles should always be selected. Where disorder of the stomach is simply of a functional character, emetics sometimes are useful. They change the secretions of this organ, by the impressions which they make upon the mucous membrane, and in that way prove salutary. Upon this principle, they are sometimes prescribed with effect in *dyspepsia* (See Eberle's Pract. vol. ii. 291). In this disease, however, they should be used with discretion, and such articles only selected as act mildly—such as ipecacuanha, &c. Tartar emetic is objectionable in every point of view. It is to be recollected that in this disease the tone of the stomach is greatly impaired already, and this would inevitably be increased by this article. The general strength, too, would be unnecessarily impaired. The only objects to be had in view in the use of emetics in dyspepsia are to relieve the stomach of offending matter, and to change, if possible, by the action of a gentle emetic, the condition of the mucous membrane. Anything beyond this may be injurious.

Dysentery is another disease of the abdomen, in which emetics have been prescribed, and with many high authorities they have been in great repute. In some cases they prove exceedingly salutary, while in others they do not appear to do much good. The rationale of their operation I take to be this. In this disease, along with the local inflammation of the mucous membrane of the large intestines, there is often an engorgement of the liver and a deficient secretion of bile. This is evidenced by the character of the evacuations. They are simple blood and mucus. Now, the effect of an emetic is to promote the secretion of bile, and if it should do this freely, it would prove salutary in this present case in the following ways: 1. It would relieve the hepatic engorgement; 2. The quantity of bile thrown into the intestines might act on the bowels as a cathartic; 3. It would equalize the circulation, and act on the skin. In all these ways it would be beneficial. If, on the contrary, the emetic only acted on the stomach without touching the liver, none of these beneficial effects would follow. In the use, therefore, of emetics in this complaint, there are two

things to be attended to. In the first place, the selection of a proper article, tartar emetic or ipecacuanha. In the second place, it ought to be given early in the disease. It will then produce more effect than at subsequent periods.

There are only two other affections of the abdomen which I shall notice, for the purpose of illustration—*obstinate constipation* and *jaundice*. In the first of these, the use of emetics is an old remedy. It was prescribed even by Hippocrates, and since his time it has been recommended by many physicians, both ancient and modern. In many cases of this kind emetics certainly produce an admirable effect, and they act both by relaxing spasm of the intestines and by promoting the flow of bile. The practice, however, does not always succeed. The cases of constipation in which I think it is most likely to do good, are those in which the disorder depends upon a torpid state of the liver.

Jaundice arises from various causes; of these I shall not speak. One of them is, the lodgment of calculus in the ducts, the effect of which is mechanically to obstruct the passage of bile. Now, in this case, emetics have been prescribed in some cases with great effect. Dr. Duncan relates, that in two instances he saw upwards of thirty gall stones voided by stool soon after the operation of an emetic (Eberle, Prac. vol. ii. p. 377). In such cases, the relaxation caused by the emetic probably proves salutary in lessening the spasm of the duct. If this be the true explanation, it indicates at once the kind of emetic to be used. It ought to be one that will act freely on the liver, and at the same time cause great relaxation. Tartar emetic is such a one. The mild emetics will not answer.

Hemorrhages.—There are two ways in which hemorrhage is said to take place—by the rupture or division or erosion of blood-vessels, and by exhalation. By most persons it is now supposed that there is in all cases a rupture of vessels in hemorrhage, though some still believe that ordinary spontaneous hemorrhage is the result of mere exhalation. By Bichat this is labored with great ability.* Now, it is evident that in cases depending upon the rupture of large vessels, emetics are remedies which cannot be resorted to with any prospect of advantage. It is only when it occurs from exhalation or from capillaries that they can be at all applicable, and in these they have been found of great value. Of the manner in which they produce their beneficial effect, it is perhaps not easy to give a satisfactory explanation. It may, however, be in one or other of the following ways:

1. By their distributing more equally throughout the system the circulating mass, and in this way counteracting the local determination upon which hemorrhage depends.

* General Anatomy applied to Physiology and Medicine. By Xavier Bichat. Translated by George Haywood, M. D., vol. ii. p. 78.

2. By the revulsive effect which they produce upon the mucous membrane.

3. By their general alterative effect, more especially on the mucous membrane.

4. By the nausea which they produce. Whatever be the mode of their operation, however, there can be no question of their utility in a great number of hemorrhages.

In *Epistaxis*, emetics were recommended so long ago as the time of Stahl. In ordinary cases of this kind no difficulty exists in controlling the hemorrhage. Sometimes, however, it becomes excessive and alarming, and in these cases the revolutionary effects of an emetic might be tried with advantage. A case of this kind is related by Dr. Osborne of Dublin.*

In *Hemoptysis*, they have also been long and highly celebrated. Nearly a century ago, Dr. Bryan Robinson of Dublin reported several cases of their successful application in this variety of hemorrhage. Their manner of operation he explains by supposing "that during the sickness that introduces vomiting, there is a constriction formed upon the extreme vessels everywhere; and that by this constriction the hemoptysis is suppressed." Upon the recommendation of Dr. Robinson, Dr. Cullen was induced to try the practice, and he says that in several cases he found that it might be employed with safety and advantage. But in one case the vomiting increased the hemorrhage to a great and dangerous degree, and the possibility of such an accident again happening prevented all further trial of it. One of the greatest advocates for the use of emetics in hemoptysis was Dr. Marryatt, and he states that he never failed, provided the patient had not been previously bled. The article which he gave was the dry *vomit*. This consisted of 2 grs. of tartar emetic and 2 grs. of blue vitriol. This was to be taken in a spoonful of water. The patient was then suffered to strain, by tickling his throat, but not to drink anything till he threw up some yellow or poraceous matter. If the sickness continued after this, he was permitted to take half a glass of raw brandy to settle his stomach. With the exception of piles, all hemorrhages were treated by Marryatt in the same way. Still more recently emetics in hemoptysis have received the sanction of a number of practitioners, and several cases have been recorded of their successful application by Dr. Osborne and Mr. Trenor of Dublin,† and Dr. Chapman of Philadelphia.‡ The article best suited as an emetic in these cases is the ipecacuanha; and Mr. Trenor has shown that by the use of this remedy in small doses, so as to produce nausea without causing actual vomiting, the same effect has been produced.

In *Hematemesis* and *Hematuria*, emetics have also been used with

* Dublin Journal of Med. Science, vol. xvi. p. 473.

† Dublin Journal of Med. Science, vol. xvi. p. 477.

‡ American Journal of Med. Science, vol. ii. p. 133.

success. In none of the hemorrhages, however, has their efficacy been more strikingly developed than in those from the uterus. The credit of establishing this practice is, I believe, more especially due to Dr. Osborne of Dublin. The article used in all cases was, I believe, ipecacuanha.

ILLUSTRATIONS OF THE EFFECTS OF EMETICS IN PROMOTING THE ABSORPTION OF MORBID ENLARGEMENTS.

Hernia humoralis.—In this affection, emetics may frequently be used with the most striking advantage; indeed, in certain stages of it, I know of no remedy so efficacious. Mr. Hunter long ago remarked, that he had known the swelling removed almost instantaneously, by the use of emetics.* In a great number of cases I have tried the practice, and almost always with success. The rapidity with which the swelling is sometimes diminished is really astonishing. In the case of a gentleman who had swelled testicles in consequence of gonorrhœa, all the ordinary antiphlogistic means had been used, together with a blister to the scrotum. On the seventh day from its commencement, although the inflammation had been subdued, yet the tumefaction remained undiminished. A full emetic of tartarized antimony and ipecacuanaha was now given, and in two hours after its operation the size of the testicle was reduced at least one third. It is only, however, in the passive stage of this affection that emetics prove so beneficial. In the early stage, where inflammation is present, they produce little or no effect.

Bubo.—In this, emetics have also been used, principally, I believe, in consequence of the recommendation of them by John Hunter. He relates a remarkable instance of their efficacy in the case of an officer who had a bubo at Lisbon. In his own words, "it came to a fair suppuration, and was almost ready to burst. The skin was thin and inflamed; and a plain fluctuation was felt. I intended to open it, but as he was going on board a ship for England on the day following, I thought it better to defer it. When he went on board, he set sail immediately, and the wind blew so hard that nothing could be done for some days, all which time he was very sick, and vomited a good deal; when the sickness went off, he found the bubo had disappeared, and it never afterwards appeared."† Mr. Hunter explains the effect in this case upon the principle of "one irritation destroying another, and the sickness and the act of vomiting perhaps giving a disposition to absorption." In cases of this kind, the use of emetics is not followed, however, by the same marked effect as in hernia humoralis,—a single emetic produces but little effect, and they require to

* Treatise on the Venereal Disease, p. 84. See also Benj. Bell. vol. i. p. 204.
† On the Venereal, p. 250.

be repeated for several days in succession, imitating in this way as nearly as possible the effect of sea-sickness.*

In *morbid enlargements* of other parts, emetics may sometimes prove very beneficial. Mr. Cruikshank mentions a case of swelling of the knee, which was cured by the patient vomiting for forty-eight hours, in consequence of his taking a large dose of the salt of tartar (carb. potass.) instead of soluble tartar (tartar potass.) Rush. vol. ii. p. 182.

INDIVIDUAL EMETICS.

IPECACUANHA.

This article is the product of the *Cephælis Ipecacuanha*, a plant found native in the Brazils. It grows to about the height of a foot, and flourishes in moist and shady situations. The root is from four to six inches long, and about the size of a goose quill. The plant flowers in the months of January, February, and March, and during this period, the root, which is the part used in medicine, is collected. It is separated from the stem, and after being cleansed, is hung up in the sun to dry. In this state it is exported in bales.

Physical Characters of the Root.—The root comes in pieces about three or four inches long, and at its thickest part about the size of a goose quill. It is irregularly bent and twisted, and surrounded by numerous rings of various sizes, separated from each other by circular grooves or depressions. It is from this circumstance that the genuine ipecacuanha root is termed *annulated*. The cortical part makes up the largest proportion of the root, constituting about four fifths of the whole. It is thick, of a horny hardness, and breaks with a resinous fracture. It is this which principally contains the active properties of the root. The woody part is a thin cord of a whitish color and is nearly inert. The *powder* of the ipecacuanha is of a light yellowish color, having a faint and disagreeable smell, with a bitter, sub-acid, and nauseous taste. By exposure to light and air, the active properties of it are liable to be impaired. For the purpose of preserving it, therefore, it should be kept in vials well corked and secluded from the light.

Varieties of the genuine Ipecacuanha Root.—As found in the market, three of them are recognised, distinguished from each other by their color, viz. the *brown*, the *red*, and the *grey*. All these, however, are *annulated* and are derived from the same plant,—the *cephælis ipecacuanha*,—the varieties of color being owing simply to difference in the age of the root, the nature of the soil, the mode of drying, &c.

* Swedian says, "Success has attended the use of emetics, repeated for two or three days; in this way buboes have been discussed, which were ready to burst.—P. 225.

Besides the foregoing, which is the genuine root, there are two others, which are sometimes brought into the market and which pass under the general name of ipecacuanha.

(*a.*) The first of these is the *Striated Ipecacuanha.* This is the product of the *Psycotria emetica,* a small shrub from fourteen to eighteen inches in height, growing in Peru, and some other parts of South America. It is known by the name of the *Peruvian ipecacuanha;* and from the dark color of the epidermis when dry, it is sometimes called the *black ipecacuanha.* This root is destitute of the rings which characterize the genuine root—the ridges on its surface being longitudinal—and from this circumstance it has received the name of *striated.* The woody part of the root is much greater in proportion to the cortical part than it is in the genuine ipecacuanha.

(*b.*) The *Undulated Ipecacuanha.* This is obtained from the *Richardsonia scabra,* a plant growing in the Brazils. It is also called the *white ipecacuanha.* The surface of the root has no rings upon it, but presents an undulated or wave-like appearance, with indentations on one side and prominences on the other. When broken, it presents a dull, white, farinaceous appearance.

Chemical Composition.—The discovery of the active principle of ipecacuanha is one of the triumphs of modern chemistry. By Majendie and Pelletier, in 1817, the presence of an alkaline principle was established, to which the name of *Emetine* was given, but since then it has been called by the name of *Emetia.* It is upon this principle that the active properties of this drug are supposed to depend. Analysis has proved that emetine exists in various proportions in the different varieties. In 100 parts of the cortical part of the *brown annulated ipecacuanha,* there were 16 parts of impure emetine, and in the ligneous part, 1·15. The *red annulated ipecacuanha* contains 14 parts of emetine in 100. The *grey* not analysed. The root of the *Psycotria emetica* was found to contain only 9 parts of emetine in 100, and that of *Richardsonia scabra* only 6 parts in 100.

Besides emetine, the other ingredients found in the ipecacuanha root are variable proportions of starch, fatty matter, wax, gum, ligneous matter, and traces of gallic acid.

Ipecacuanha is partly soluble both in water and in alcohol. By decoction, its virtues are impaired.

Effects.—These vary with the dose. In very small doses, it promotes secretion from the mucous membrane of the stomach, excites the appetite, and promotes digestion. In doses somewhat larger, and yet not sufficient to cause vomiting, it produces nausea, and acts upon the bowels, increasing secretion from the mucous membrane, and causing evacuations from those organs. In doses sufficient to excite nausea, it extends its influence to the mucous lining of the pulmonary organs, promoting secretion and

expectoration. In suitable doses, it produces vomiting. As an emetic, this article is distinguished by the certainty as well as mildness with which it operates. Given in large doses, it never acts as a local irritant, and scarcely ever excites excessive vomiting. As a general rule, it appears to be thrown off from the stomach in the first vomitings. This may account, no doubt, in some cases, for its not operating more violently. The evacuations produced by it are not usually bilious. This would seem to show that its action is not extended to the liver in any special manner. On the system at large, its action is not attended with that prostration which characterizes some other emetic agents. From all this, the uses of this article are evident. Whenever it is desirable, by means of an emetic, not merely to evacuate the stomach, but to make a peculiar impression on the mucous tissue, and to promote secretion from it, without producing any great general prostration or relaxation, this is the best article that can be used.

From the mildness with which the ipecacuanha operates, it is admirably suited as an emetic for children.

It is important to recollect that, upon some constitutions, this article produces anomalous and unpleasant effects. The mere odor, in some persons, frequently excites the most distressing symptoms. In the Philosophical Transactions, a case is recorded in which asthmatic fits were constantly induced by it. In some cases, catarrh has been known to be produced by it; and Dr. Paris relates the case of a lady, who was constantly seized with violent dyspnœa whenever the powder was brought into her presence. Asthmatics are very commonly distressed, and a paroxysm brought on, by the smell of ipecacuanha.

MODES OF ADMINISTRATION.

1. *Powder.*—This is the form in which this is generally used, and for an adult the dose is from 15 to 30 grains mixed in a little water. Young infants, ½ gr. to 1 gr.

2. *The Wine of Ipecacuanha.*—This is prepared by macerating ℥i of the bruised root in a pint of sherry wine for two weeks and then straining. It is a good preparation, possessing all the virtues of the powder. To an adult the dose as an emetic is about an ounce; to a child of from one to two years, about a drachm, to be repeated every fifteen or twenty minutes till it operates. This is a valuable preparation for children; although efficacious, it is milder and safer for them than the antimonial wine.

3. *Syrup of Ipecacuanha*—Process U. S. Disp.—Take of ipecacuanha in coarse powder 1 ounce, diluted alcohol 1 pint, syrup two pints. Macerate the ipecacuanha in the alcohol for fourteen days, then filter, evaporate the filtered liquor to two ounces, then filter again and mix with the syrup, and evaporate by means of a water bath to a proper consist-

ence. This is an excellent preparation for children. Dose as an emetic, half to one teaspoonful—for an adult, ℥i to ℥iss.

EMETIA CALLED ALSO EMETINE, EMETA, AND EMETINA.

This is the peculiar substance which exists in ipecacuanha, and on which its values depend. It was discovered by Pelletier in 1817.

Properties.—Pure emetine is in the state of a white powder, with a taste slightly bitter and without smell. Exposure to the air does not affect it. In cold water it is slightly soluble—in warm water rather more so. In alcohol it is very soluble. It restores the color of vegetable blues and combines with the acids, forming crystallizable salts. It is therefore a vegetable alkali.

Effects.—The same as ipecacuanha. According to Maguire two grains of the pure emetine are sufficient to kill a dog, and in the human subject he has seen one sixteenth of a grain produce vomiting.

Forms of Administration.—As the pure emetine is very insoluble, it is previously to be dissolved in a little sulphuric or acetic acid and then taken in rain water. Or the simple emetine may be taken mixed in syrup. The dose is about one quarter of a grain. The best mode of taking it is to dissolve one grain in a little acetic acid and then add three or four ounces of rain water. Half an ounce may then be taken every fifteen or twenty minutes until vomiting is produced.

TARTAR EMETIC.

This is the tartrate of antimony and potash, and is the most valuable of the preparations of antimony. It does not exist native, but is always prepared artificially. It is said to have been first made by Adrier Mynsechs, in 1631. It is prepared thus :—

Take of sulphuret of antimony, in fine powder, five ounces; muriatic acid, twenty-five ounces; nitric acid, two drachms; water, a gallon. Mix the acids in a glass and add by degrees the sulphuret of antimony; digest the mixture with a gradually increased heat till effervescence ceases; then boil for one hour; filter when the liquid is cold and pour it into the water; wash the precipitate well till quite free from acid and dry it, and take of this two ounces; bitartrate of potassa in very fine powder, two ounces and a half; distilled water, eighteen fluid ounces; boil the water in a glass vessel, then add the powders previously mixed and boil for an hour; lastly, filter when hot and set aside to crystallize. The mother liquor will yield by evaporation additional crystals which are to be purified by another crystallization.

Properties.—Tartar emetic is a crystalline salt of a pure white color, with a styptic metallic taste, but without any smell; on exposure to the air, they slightly effloresce on the surface and become opaque. In alcohol tartar emetic is insoluble. In water it is soluble, fourteen times its weight of cold water and twice its weight of boiling water dissolving it. If the aqueous solution be kept for some time it decomposes spontaneously. (This is owing to the spontaneous decomposition of the tartaric acid. Murray, p. 466.)

Purity.—As this article is only used in small doses, it is important to have it pure. As found in the shops, it may be in two different states—in that of *crystal* or that of *powder*. The last of these is the most common and most likely to be adulterated. As a general rule, therefore, the best plan, if possible, is to purchase it in the form of crystal. In this state of course there can be no other impurity than such as may arise from the imperfect preparation of the salt, while in the form of powder various substances may be mixed up with it.

Tests of the Purity of Tartar Emetic.—The salt should be entirely soluble in twenty parts of water, and the solution is not affected by adding the ferrocyanide of potassium. A more delicate test:—dissolve one part of the suspected salt in forty parts of water; dissolve eight parts of the acetate of lead in thirty-two parts of water and fifteen parts of acetic acid; mix the solutions; if a precipitate appear, cream of tartar is present. *Rationale.* The strongly acid solution of the acetate of lead holds the tartar emetic in solution but lets fall the cream of tartar. This salt will detect one per cent. of cream of tartar.

Physiological Effects.—In small and repeated doses, tartar emetic promotes the secretions of the mucous membrane and of the skin, and lessens the action of the heart and blood-vessels. In larger doses, it acts as an emetic. In still larger doses, as a local irritant, producing heat and pain in the stomach, frequent and severe vomiting and sometimes hiccup. Along with this there are acute colicky pains in the bowels, together with free purging. To this succeed general prostration, severe cramps, delirium, convulsions, and death. In some cases, neither vomiting nor purging has occurred, and this has always been attended with an aggravation of the other symptoms. In other cases, there has been a peculiar difficulty of swallowing so as almost to prevent it altogether. On dissection, in cases of poisoning, the mucous membrane of the stomach and intestines has been found inflamed. In his experiments upon animals, Majendie also found the lungs inflamed. As an *emetic*, this article is peculiar, operating with great certainty and activity upon the stomach and abdominal viscera, and at the same time producing general relaxation. Between this and the milder vegetable emetics, such as ipecacuanha, there are several important points of difference which require to be understood. In the first place, it makes a more permanent impression on the stomach itself,

and in consequence of this causes a more full and perfect evacuation of that organ.

In the second place, its action is not so much confined to the stomach as that of ipecacuanha. It extends its influence to the duodenum, inverting the action of that intestine, and at the same time excites the liver and promotes the secretion of bile. Hence it is that free discharges of bile attend the operation of this emetic.

In the third place, it extends its influence to the intestinal canal, causing free evacuations from the bowels. This is owing, in part, to the free secretion of bile into the intestines, and in part to the general relaxation which it produces.

In the fourth place, it affects the skin more, producing freer perspiration than other emetics.

Finally, it affects the whole system more powerfully, lessening arterial action and causing more general relaxation and exhaustion.

From the foregoing view of the effects and peculiarities of this article as an emetic, it is evident that there are conditions of the stomach and of the system in which it may be used with great advantage, while in other conditions it is wholly inadmissible. Where the object is simply to evacuate the contents of the stomach—where that organ is debilitated and irritable—where there is general debility or considerable prostration of strength, this active medicine may do much injury; and ought, in these cases, to be carefully abstained from. On the other hand, when you wish to make a powerful impression on the stomach and abdominal viscera, and at the same time to cause general relaxation, there is no article which can be compared with it.

Tartar emetic is an article which ought to be used with great caution in children.

Mode of Administration.—When used as an emetic, this article is given in solution with pure water, and to an adult in doses of two or three grains. This generally produces full vomiting. The better method, however, is to give it in divided doses. For this purpose, two or three grains are dissolved in three or four ounces of water—of this one fourth may be taken every quarter of an hour until vomiting is produced. The operation of it is to be assisted by the free use of warm water or chamomile tea. Given in this way, you have the operation of this article more under your immediate control, and you guard against the unpleasant effects which sometimes result from the use of a large dose given at once.

To children, one eighth to one sixteenth of a grain. But it should never be given where gastric or intestinal irritation is present, nor unless inflammatory action require it.

ANTIMONIAL WINE.

This is prepared by dissolving two scruples of tartar emetic in twenty ounces of wine. Each fluid ounce, therefore, contains two grains of the tartar emetic. It is important to recollect that the strength of antimonial wine depends entirely upon the care with which it is prepared. If the tartar emetic be impure, or the wine be not of the proper kind, decomposition takes place, which impairs its activity. As the result of investigation, it has been ascertained that good *sherry* is the only kind of wine which does not decompose the antimony. Every other wine acts upon it in such way as sometimes scarcely to leave any trace of the antimonial salt in the preparation. The way in which the decomposition takes place, is by the potash of the tartar emetic attracting tartaric acid from the wine, and thus breaking up the affinity which keeps together the potash and the antimony. In consequence of this, a precipitate is thrown down, consisting of oxide of antimony, with a portion of super-tartrate of potash. Now, sherry wine being free from acid, obviates this effect. If the tartar emetic, too, should be impure, mixed for example with super-tartrate of potash, there will be a precipitation, although the strength of the solution may not be affected. To have it good, therefore, and to obtain a perfect solution, it is necessary to employ the pure crystallized tartar emetic and good sherry wine.

The advantage of this preparation is, that it supplies us with a permanent solution of tartar emetic, by which very minute doses can be given. On this account, it is much used for children. From what has been said, it is evident that this preparation is very liable to be uncertain in its strength; and on this account, in acute cases, preference should always be given to the watery solution of tartar emetic.

Dose.—As an emetic for children, half a drachm may be given every fifteen minutes until it operate.

SULPHATE OF ZINC.

Zinc was not known to the Greeks, Romans, or Arabians. It was first noticed in 1280. The preparation at present under consideration was first known in Germany about the middle of the sixteenth century. In the mines of Goslar, in Germany, it is found native—what is used in medicine is prepared artificially.

There are two kinds of it met with in the shops. The *impure*, or what is commonly called *white vitriol*, and the *pure* or crystallized.

Sulphate of zinc is prepared by the direct combination of its constituents. For this purpose zinc, cut into small pieces, is subjected to the action of diluted sulphuric acid—effervescence takes place; when this is finished,

the solution is filtered through paper; it is then boiled down until a pellicle appears, and set aside to crystallize. Here water is first decomposed. The zinc is oxidized and then the sulphuric acid unites with it. The hydrogen escaping causes the effervescence.

Properties.—When *pure*, this salt exists in the form of small white rhombic prisms, resembling very much in appearance the crystals of sulphate of magnesia. It has no smell, but has a styptic metallic taste; when exposed to dry air it slightly effloresces—soluble both in *hot and cold water.* Two and a half times its weight of water at 60° dissolves it, and less than its own weight of boiling water does the same. In *alcohol* it is insoluble.

Effects.—Sulphate of zinc is a powerful and in many cases a valuable emetic. It is peculiar in its action, combining with its emetic operation the effect of a local astringent, checking secretion from the mucous membrane of the alimentary and pulmonary tissues. It is more *speedy* in its operation than any of the preceding articles. Unlike ipecac and tartar emetic it causes little or no nausea, and does not produce repeated emesis. On the mucous membrane it acts powerfully as an astringent, separating and clearing out morbid accumulations of mucus, and moderating and even suspending secretion for a time after its operation. On the system at large, it does not produce any of the debilitating and relaxing effects which follow the use of other emetics; and even the stomach itself seems to be invigorated after its action.

As an emetic, it is suited to all such cases as require a prompt and complete evacuation of the stomach, unaccompanied by any relaxing effects on the system. The most frequent use of it is in cases of poisoning. It is also used, in cases where it is desired, by means of an emetic to unload the pulmonary organs of superabundant mucous secretion, and to check the further formation of it.

In *excessive doses*, sulphate of zinc operates as an irritant poison.

In using this article, the crystallized ought always to be preferred. It is purer, and in consequence of its containing more water of crystallization, not so strong.

Dose, &c.—For an adult, 10 to 20 grs. as an emetic. To be taken in ℥ij of mint or common water, with the addition of ʒi of sp. lavender. For children, grs. ij may be dissolved in ℥j of water—a teaspoonful every ten or fifteen minutes.

SULPHATE OF COPPER.

Known by the common names of *blue vitriol, blue stone*, &c.

There are several modes in which this article is obtained.

1. From the native sulphuret. From exposure to a moist atmosphere this undergoes chemical changes; the sulphur is converted into sulphuric

acid, while the copper is oxidized, and thus the sulphate is formed. In this state it is washed down by the rain and other waters of the mines. By simply evaporating these waters the salt is obtained. A large proportion of it is thus obtained from the copper mines.

2. A second mode is to roast the copper pyrites (sulphuret of copper) in a reverberatory furnace, during which it absorbs oxygen and is converted into the sulphate. It is then lixiviated and the solution evaporated till it forms crystals.

3. The third mode is by the direct action of sulphuric acid on copper. This is the mode in which it is usually prepared in this country.

Properties.—A crystalline salt of a beautiful deep blue color. The crystals are semi-transparent, and when exposed to the air slightly effloresce—without smell, but has a harsh, styptic, metallic taste. Soluble in four parts of water at 60°, and in less than two parts at 212°. In alcohol insoluble.

Purity.—The sulphate of copper of the shops is generally very pure. The only adulteration which it sometimes contains is *sulphate of iron*, existing in the native sulphuret.

Effects.—In its local action astringent, and in large doses irritant. As an emetic, prompt and powerful—very analogous to the sulphate of zinc used in the same cases, especially in poisoning. Not so good, however, as the *sulphate of zinc*, because more apt to cause local irritation and inflammation, where it is retained, as is frequently the case in poisoning by narcotic agents.

Dose.—Adults, 5 to 10 grs. dissolved in two or three ounces of water. Children, one eighth to one sixth gr. every quarter of an hour.

SQUILL.

The product of the *Scilla maritima*, the *Sea Onion*, a perennial plant growing to the height of two or three feet, shooting from a large bulb, with fibrous roots. It grows native on the sandy shores of the Mediterranean, in France, Spain, Italy, Greece, Syria, and Barbary. The part used in medicine is the *bulb*. In its appearance this resembles the common onion, only much larger. Its size, however, varies from that of a man's fist to a child's head. It is composed of concentric layers or scales, each of which is covered with a thin membrane of a whitish color. The fresh bulb contains a large proportion of acrid juice, which possesses the property of inflaming and vesicating the skin. By drying the greater part of this acridity is dissipated. For medicinal purposes, the bulb is cut into small slices and dried. In the shops, there are found two varieties of it—viz. the *red* and the *white*. In their general properties, however, they do not differ, and accordingly are used indiscriminately. The squill has no

smell—its taste is bitter, acrid, and nauseous—as it has a great affinity for moisture, and then becomes mouldy, it should be kept in tightly corked bottles.

Composition.—According to the analysis of Vogel, the dried squill contains an *acrid volatile matter*—a bitter substance called *scillitina, tannin, gum, citrate of lime*, and *lignin.* Its active properties are extracted by water, vinegar, and alcohol.

Scillitina.—According to Vogel, 100 parts of the dried squill yielded 35 of this principle. A whitish transparent deliquescent substance, which, when dry, has a resinous fracture, and may readily be reduced to powder. Its taste is bitter and subsequently sweetish. It readily dissolves in water, spirit of wine, and acetic acid.

The substance sold in the shops as scillitina is a *treacle-like liquid.* Pereira and Christison say it is crystalline, sparingly soluble in alcohol, insoluble in water or volatile oils, and capable of neutralizing acids. A grain of this kills a dog.

Effects.—In *small doses*, squill acts as a stimulant to the mucous membrane—especially the bronchial and gastro-intestinal portions of it, promoting secretions from them. At the same time it excites the secretory action of the kidneys.

In *larger doses*, it causes nausea, vomiting, and sometimes purging. With regard to its action on the circulation, there is a difference of opinion. By some it is supposed to excite the pulse, and, therefore, is objected to in all cases where inflammatory action is present. This, however, does not appear to be the case. As a general rule it does not excite the circulation. Nevertheless, from its acting as a local stimulant, it is not so suitable where inflammation is present.

In *excessive doses*, it acts as a narcotico-acrid poison, causing severe vomiting, purging, griping, strangury, inflammation of the stomach and intestines, convulsions, and death. 24 grs. of the powder have proved fatal.

As an emetic, it is used when it is desirable to make a certain impression on the mucous membrane of the pulmonary organs, with a view of promoting secretion, or evacuating accumulations of mucous secretion in the bronchial tubes. It should not be used where inflammatory action runs high.

As an emetic, this article is little used at present, except for children.

A great objection to it is the uncertainty of its action. In some cases very small doses cause severe vomiting, while in others large doses produce but little effect. It is objectionable, too, where the stomach is irritable.

FORMS.—*Powder.*—Ten grs. act as an emetic in an adult. Not used in this way.

In children the only forms in which it is used are those of *oxymel* or *syrup.*

Oxymel.—Prepared by boiling the vinegar of squill with honey.

Syrup.—Boiling vinegar of squill with sugar. Half a teaspoonful to a teaspoonful every quarter of an hour till it operates.

A common mode of giving this to children is to combine two parts of syrup of squills with one part of antimonial wine, and to give a teaspoonful of this every quarter of an hour till it operates.

LOBELIA INFLATA.

This is a biennial plant, known by the common names of the *Indian tobacco, wild tobacco, emetic weed, &c.* It grows native in every part of the United States, and is generally found along road sides and in old uncultivated fields. It rises to the height of from one to two feet, with a single, erect, hairy stem, branching about midway. The fruit is an oval, striated, inflated capsule, containing in its two cells a great number of small brown seeds. It commences flowering in the month of July, and continues in bloom until November. When broken or cut it emits a milky juice. The proper period for gathering this plant is in the months of August and September, when the capsules are full and numerous, and when the leaves are just beginning to fade. It is then to be plucked up by the roots and dried quickly, either in the sun or in an oven. It may be kept whole or in powder. It should always be packed tightly and kept for some time in a dark place. Every part of the plant possesses medicinal properties; but the parts most powerful are the *leaves* and *capsules.* These should, therefore, be preferred. The seeds are almost entirely inert.

Physical Properties.—Indian tobacco, when dried, has a smell slightly irritating. When chewed for a short time, its taste is acrid, resembling that of common tobacco, and like that, too, causes a flow of saliva, sickness at stomach, and giddiness. Its powder is of a greenish color.

Chemical Composition and Properties.—According to the recent analysis of Doctor Procter, the lobelia contains a peculiar alkaline, acrid principle, upon which its active properties are supposed to depend. This is called *Lobeline.* Besides this, it contains gum, gallic acid, volatile oil, greenish resin or chlorophyle, a green, fixed, oily matter, salts of lime and potassa, oxide of iron and lignin.

Physiological Effects.—In small doses, this article promotes the secretions of the gastro-pulmonary tissues and at the same time affects the nervous system as a narcotic. In larger doses, it proves emetic, and its operation is accompanied with copious secretion from the mouth and fauces and general relaxation. In still larger doses, it acts as a poison, producing great anxiety and distress, excessive prostration, convulsions, and finally death.

From the preceding account of its effects, the indication for its use is

obvious. It may be resorted to whenever it is desirable to produce an emetic effect and at the same time free secretion from the gastro-pulmonary tissue, and to make an impression on the nervous system with the view of causing relaxation.

By many physicians the lobelia is looked upon as a dangerous remedy, and its use has been accordingly proscribed by them in all cases. This is certainly going too far. If imprudently used, it is unquestionably a most dangerous remedy, and in the hands of empirics it has been the cause of melancholy and fatal results. The same, however, may be said of many other remedies in common use. This, therefore, is no valid objection to the cautious and prudent use of it. The testimony of many highly respectable practitioners has certainly established the fact that, if properly exhibited, it is both a safe and valuable remedy.

FORMS OF ADMINISTRATION.

1. *Powder.*—This is probably the best form in which it can be used as an emetic. It may be given in syrup or made into pills. The average dose for an adult is from ten to twenty grains, which may be repeated in half an hour, if necessary.

2. *Tincture.*—This is prepared by digesting two ounces of lobelia in two pints of diluted alcohol; digesting for ten days and then straining. Of this half an ounce is a dose as an emetic. To produce simply the antispasmodic and expectorant effect, one or two drachms may be given every two or three hours; to a child five to twenty drops.

SINAPIS (*mustard*).

Of this there are two species—*sinapis nigra* and *sinapis alba.* The sinapis nigra is a plant three or four feet high, with wide spreading branches. The sinapis alba is rather smaller than the preceding. They derive their names from the color of the seeds. Both plants are natives of Europe, but cultivated in this country. The seeds of the black mustard are much smaller than those of the white. They are, however, analogous in their properties and are used indiscriminately. In their entire state, these seeds have no smell, but when bruised have a peculiar and penetrating odor. The black is much more pungent than the white.

Mustard is a powerful stimulant to the stomach and the whole system. In *small* doses it excites the stomach and promotes digestion. In *larger* doses, it excites vomiting, and in still larger doses it acts as an irritant, causing vomiting, purging, and inflammation of the stomach and bowels. When used as an emetic, it is only suited to cases in which there

is great torpor of the stomach, and where that organ requires to be powerfully stimulated, such as cases of narcotic poisoning.

Mode of Administration.—From a tea-spoonful to a table-spoonful of the flour of bruised mustard in a tumbler of water.

ANTHEMIS NOBILIS (*chamomile*).

This is a native of Europe growing all over the continent. In England also it grows wild. From the large quantities of it which ~~are~~ used, it has been made an object of cultivation in that country, and most of what is used in medicine is raised by the growers of medicinal plants. The part used is the flower, and by cultivation these become *double*, and in this state are generally preferred. What is used in this country is generally obtained from England and Germany.

Chamomile flowers have a strong and fragrant smell, and a bitter, aromatic taste. The best are those which are large and of a whitish color. By long keeping they lose much of their active virtue. According to analysis, they contain a *volatile oil*, *bitter extractive*, and *tannic acid.*

Effects.—Chamomile is an aromatic bitter tonic, and it is only when given in a certain way that it proves emetic. This is in the form of warm infusion and taken in considerable quantity—℥ss. to a pint of boiling water. It is mild in its action as an emetic, and is chiefly used to aid the operation of other emetics.

TURPETH MINERAL.

This is the hydrargyri sulphas flavus. It was formerly much used, but has been of late pretty generally discarded. Still it is a powerful and in certain cases a valuable emetic, especially in croup and cynanche maligna. It will sometimes act well in cases where other emetics fail to operate or run off by the bowels. It often produces very copious secretion from the fauces.

Dose less than three grains.

COMBINATION OF EMETICS.

Emetics are combined either, First, to increase their efficiency by securing the effects of different agents, e. g. tartar emetic with ipecacuanha. Ipecacuanha is limited in its action to the stomach. Tartar emetic affects the duodenum, liver, &c. By uniting the two, we secure the prompt and

certain action of the vegetable with the greater power of the mineral emetic.

Second, To modify the effects of one remedy by the other, e. g. Squill, though it promotes nervous secretion powerfully, is at the same time stimulating; this latter quality is corrected by antimony; and, on the other hand, the depressing effects of antimony are moderated by the squills. Hence the great value of Coxe's hive syrup, in which both these emetics are united with senega.

CATHARTICS.

Cathartics are defined to be "those medicines which quicken or increase the evacuations from the intestines; or which, when given in a certain dose, produce purging."*

In relation to this definition the same remarks may be made which were applied to emetics. As a simple definition of the term cathartic it is very correct. Purging, however, is only one of the effects of these articles. They produce a great number of others, all of which are necessary to be taken into view for the purpose of justly appreciating their operation on the living system. In treating of this class of agents, I shall observe the same order which was adopted when discussing the subject of emetics.

I.—OF THE ORGANS IMMEDIATELY ACTED UPON BY CATHARTICS.

These are the intestines, the liver, and the pancreas.

The Intestines.—These form a continued canal from the pylorus or lower orifice of the stomach to the anus. Their whole length is about six times that of the body. From this simple fact some idea may be formed of the extent of surface upon which the immediate impression of cathartics is made. These intestines are divided into the *small* and the *large* intestines, differing from each other in a number of important particulars. The small intestines are about four times as long as the large. In examining the minute structure of these organs we find that they are made up of three different coats or coverings—the external or serous covering, the middle or muscular, and the internal or mucous lining, all united together by intermediate cellular tissue. Of these, the two last are especially important, as connected with the operation of cathartics. The muscular coat is made up of two sets of fibres, one longitudinal, while the other is circular or transverse. By a regular series of contractions of these fibres from above downwards (the one set shortening, and the other contracting the canal), there is a motion produced in the intestines which is called the *peristaltic motion*, and by means of which the contents of the intestines are propelled downwards. In the large intestines, especially the

* Murray.

colon, this coat assumes a different character. The longitudinal fibres here are collected into three bands, which are called ligaments of the colon. At the same time, the circular fibres are also formed into bands, more numerous but equally distinct. In consequence of this, in a great number of places, the intestine consists only of the serous and mucous coats. These places between the muscular fibres bulge out and are formed into distinct cavities, which are termed the *cells of the colon*. In consequence of this organization, the descent of the fæces is rendered more gradual, at the same time that when the action of the canal becomes torpid, they do great mischief by retaining the contents. The peristaltic action in the large intestines is much less powerful than in the small; on the other hand, however, they enjoy the benefit of greater pressure from the abdominal parietes—the whole length of the colon being contiguous to them. In the inner lining of the intestines is a mucous tissue. It is plentifully supplied with blood-vessels and mucous follicles, from which is poured out the mucus which lines the whole tract of intestines. The fluids secreted and poured into the intestines are an aqueous or serous fluid from the exhaling vessels—mucus, bile, and the pancreatic fluid. After this simple view of the construction and function of these organs we shall be better able to understand the precise effects of cathartics upon them.

II.—OF THE EFFECTS OF CATHARTICS.

When a cathartic is taken, the organ immediately affected is the stomach, and the first effect which it produces is a disgust for food. Frequently nausea ensues, and sometimes actual vomiting. If this takes place, the medicine may be ejected, and no other effect produced, the stomach and other organs returning in a short time to their natural state. If the medicine be retained, in about an hour (more or less, according to circumstances) an uneasy sensation is felt in the abdomen, which increases gradually, and sometimes amounts to actual pain. An increase of internal heat now takes place, accompanied with borborygma, and a feeling as if the lower part of the abdomen were swelled. At the time these sensations are experienced, the pulse becomes small, and a slight sense of coolness is felt over the surface. In a short time, however, the pulse becomes quicker and more frequent; animal heat is developed, and the skin becomes dry and warm. During this period, colicky pains are felt, and evacuations now take place from the bowels, which are repeated more or less frequently according to the activity of the purge and the actual condition of the intestinal canal. Not merely the number, but the size as well as quality of the evacuations, differ greatly according to circumstances.

The length of time which a purge takes to complete its operation is from

six to eight hours, generally speaking. In this respect, however, there is considerable difference, according to the article which may be used. Some take even longer time, say twelve hours; while others again act in three or four hours.

After the operation of medicine is finished, the patient is generally left in a state of lassitude and heaviness, sometimes with a tendency to sleep.

Such are the ordinary sensible effects observed in those who have taken a cathartic. To understand more fully the changes which the organs and the system at large undergo during this process, it will be necessary to analyse the foregoing effects a little more in detail. In doing this I shall pursue the same order as in emetics.

1. *The first effect of Cathartics is to produce a peculiar action in the mucous membrane lining the intestinal canal.* This is accompanied with a determination of blood to the part, together with augmented sensibility. To these are owing the sense of heat and swelling which are amongst the first effects of this class of remedies. The action thus excited by cathartics is by no means uniform. According to the article used, it differs materially in a great number of respects. In some cases it is mild in degree, and transient in duration. In other cases it is so decided as to produce irritation, and even actual inflammation. In some cases this action is extended to the whole intestinal tract, while in others it is limited to particular portions. From experiments made upon living animals, it would appear that the parts of the intestinal canal which are principally acted upon by purgative medicines are the duodenum, the colon, and the rectum. In persons, too, who have died shortly after taking drastic purges those parts have been found in a state of inflammation. The reason of this probably is, that the jejunum and ilium, from the fact of their being loose and floating, are enabled to propel the medicines more quickly through them, and in this way lessen their action to a certain extent. The duodenum, colon, and rectum on the other hand are fastened down.

2. *The next effect of Cathartics is to cause secretion from the mucous membrane of the intestines.* This is sometimes the result of the above described irritation; but most cathartics operate in a different and purely physical way, by what is called endosmosis and exosmosis. With the laws regulating these you are probably familiar, and thus prepared to understand how, if a saline solution be introduced into the intestines, it has an influence on the blood-vessels, which varies according to the strength of the solution. If it be somewhat concentrated, the effect of its proximity to the blood-vessels will be to cause the exosmose of the serum to exceed the endosmose. The current will be strongest from within the blood-vessels and into the intestine, and the saline solution will be diluted to near the standard of the blood. If, on the contrary, the saline solution is very weak, its specific gravity below that of the serum of the blood (1025·30),

the current will be reversed and endosmosis will take place, the saline solution will flow into the vessels, in other words it will be absorbed.

It is in this way that the salines, and probably rhubarb, senna, and the resinous purgatives, as aloes, scammony, and jalap, act as purgatives.

3. *Cathartics increase the natural action of the muscular coat of the intestines.* From the intimate connexion existing between the mucous lining and the muscular coat of the intestines, the impression made upon the former is speedily transmitted to the latter. In this way, as well as from the stimulus of the various matters secreted in the intestines, the muscular tissue is called into increased and sometimes irregular action. To this are owing the colicky pains which are felt during the operation of cathartics. In the impression which is thus made upon the muscular coat of the intestines, there is a great difference among cathartic agents, some acting powerfully in this way without causing any free secretion from the mucous surface.

4. *Cathartics promote secretion from the liver.* [This they do by special action of their molecules upon the liver after their absorption.—Ed.] In the power which they possess of thus calling the liver into action there is a marked difference between cathartics. Calomel, for example, possesses it in an eminent degree, while the neutral salts are destitute of it.

5. *Cathartics increase the secretion from the pancreas.* This is nearly as certain as their operation on the liver, although from the character of the secretion, &c., we cannot have the same demonstrative proof of it. It is effected in the same way as in the case of the liver.

6. *Actual evacuation of the contents of the intestines is the last effect produced.* This is accomplished in the following way. The rectum first contracts ; this is immediately followed by a similar action of the diaphragm and abdominal muscles. By this combined pressure downwards, the levator ani is elongated, and the resistance of the sphincters is overcome and evacuation takes place. When the fæces have been voided, the diaphragm rises and the abdominal muscles become relaxed—the levator ani retracts the intestine, and it is again closed by the sphincter. During this process the lungs are filled with air, and expiration is prevented.

From the foregoing analysis it appears that purgation does not consist simply in evacuating the contents of the intestinal canal. In addition to this, it sets into more or less active operation and increased secretion, a large extent of mucous tissue, and a number of important glands. It is only by bearing this in mind that anything like a just conception of the influence of cathartics upon the system can be formed.

Of the Remote Effects of Cathartics.—These are various and important.

(*a.*) *On the Mucous System.*—A very large extent of this system, viz. from the stomach to the rectum, is directly acted upon by cathartic medicines; and the effect here is, as already stated, to increase exhalation and secretion. From the great determination of fluid which thus takes place to the intestines, the secretions from other portions of the mucous system, instead of being increased, are diminished. This is particularly the case with the part of it which lines the mouth and œsophagus. Hence it is, that during the operation of cathartics, the mouth becomes dry, and thirst is created. A similar effect is also produced upon the membrane lining of the trachea and bronchial tubes.

(*b.*) *On the Brain and Nervous System.*—The effect of cathartics is to impair the general energy of the brain and nervous system. In consequence of this, debility ensues, the intellectual functions are not performed with vigor or ease, and there is a great disposition to drowsiness and sleep. All this is owing to the concentration of vital energy in the intestinal canal, depriving the brain of its due share—to the great determination of blood to this part,—as well as to the direct debility induced by the evacuations which cathartics produce, and the consequent change in the character of the blood.

(*c.*) *On the Vascular System.*—The first effect of cathartics on the circulation is to produce an unequal distribution of blood throughout the system. In consequence of the action excited in the intestines, a great determination of blood takes place to these organs, and, as a matter of course, the relative proportion in other parts of the system must be diminished. Hence it is, that, during the operation of these agents, the pulse becomes more frequent and smaller than natural, and, when colicky pains come on, unequal, just as in enteritis and in dysentery the pulse is small and frequent. After the operation of the cathartic is completely over, and the temporary determination to the intestines has subsided, the blood again becomes uniformly distributed throughout the system—the pulse will be found lessened both in force and frequency. This is evidently the result of the depletion which the system undergoes, and is in proportion to the number and copiousness of the evacuations.

During the mechanical act of passing the fæces, an effect occurs which it is important to notice. From the muscular contraction and straining which take place, there is a temporary interruption to the free and equal circulation of the blood. The degree of this is always in proportion to the difficulty attending the operation. Hence it is that old persons whose bowels are torpid sometimes die of apoplexy while straining at stool.* On the blood itself, the effect of cathartics is, by taking from it

* Mr. Hennen says, "I scarcely recollect a situation in which bleeding after amputations, especially of the lower extremities, occurs more frequently than in the act of passing fæcal accumulations."—P. 210.

through the intestinal capillaries a large amount of its serum, to alter the quality of the general mass, by compelling (so to speak) the vessels to supply their loss from the fluids that may be within their reach. It is in this way that cathartics promote absorption, and aid in the removal of dropsical accumulations. They may promote absorption in another way. When the capillary system is inflamed and congested, it may from that cause be unable to perform its function of absorption. Cathartics, by removing the congestion or inflammation, may restore to the vessels the power they had lost.

(*d.*) *On the Cutaneous System.*—Between the skin and mucous membrane lining the alimentary canal, there is not merely a great analogy in structure, but great sympathy of action. Illustrations of this we see continually in the occurrence of cutaneous affections from disorder of the stomach and bowels. It cannot, therefore, be otherwise than that the skin should be powerfully influenced, when so extensive an action is excited in so large a portion of mucous membrane as is the case during the operation of cathartics. And such in fact is the case. Accordingly, under catharsis, the skin becomes dry and cool, and perspiration is suppressed. When the operation ceases, the function of the skin is again restored. This is the effect of a single cathartic. When frequently repeated, the effect is more permanent, and new action is eventually set up in the extreme vessels of the surface. It is by this alterative effect, as well as by the constant diversion of action from the surface to the intestines, that cathartics prove so beneficial in many cutaneous affections.

Of the Circumstances Modifying the Effects of Cathartics.—(*a.*) *Age.*—As a general rule cathartic medicines operate much more readily at an early period of life than they do afterwards. This is owing to the greater sensibility of the intestinal canal at this period. That this is really the case is proved by the fact that even without taking medicine, children have a more frequent call to evacuate the fæces, than adults. A healthy child has generally a couple of loose light-colored evacuations a day. In giving cathartics, therefore, to children, this fact should be remembered and the milder articles preferred. From the great sensibility of the intestinal canal as well as of the whole nervous system in children, active cathartics are apt to produce the most unpleasant consequences. In some cases fatal convulsions have thus been induced, while in others, especially if the purging has been protracted, general exhaustion, terminating in hydrocephalus, has been the consequence. Notwithstanding the general sensibility of the intestines of children, there is frequently a condition of these organs which enables them to bear larger proportionate doses of some cathartic medicines than adults. In children there is a great tendency to the secretion of mucus in the intestines. This becomes viscid, and adheres to the inner lining of these organs, and in this way interferes

with the action of cathartics. As we advance in years, the intestines, in consequence of their repeated stimulation, have their sensibility impaired, and their contractile power proportionably lessened. The natural secretions, too, of the mucous membrane become less copious. In consequence of all this the bowels become sluggish, and the stools more scanty and hardened. Old persons seldom have an evacuation oftener than once in two or three days. From this condition of the intestines, it happens that cathartic agents produce less effect upon old persons, and accordingly they must be used in larger doses and the more active articles selected.

(*b.*) *Sex.*—From the greater delicacy of the female constitution and from their nervous temperament, equal doses of the same medicine will be more apt to produce violent effects in them than males. This is the case with regard to cathartics, and especially the more active ones. During the state of pregnancy, cathartics should be used with a certain degree of caution, inasmuch as their use may be followed by premature action of the uterus and a consequent expulsion of the fœtus. This is owing to the sympathy existing between the intestinal canal and the uterine organs, and is more especially apt to occur in irritable temperaments and those who are prone to abortion. It is most apt to follow the use of such cathartics as produce much irritation about the rectum. In pregnancy, therefore, articles of this kind should be carefully avoided and the milder articles should always be selected. It is not to be inferred from this, however, that cathartics are always dangerous remedies during pregnancy. On the contrary, in cases of acute disease, very active articles may and have been given not merely with impunity but with benefit. During the yellow fever of 1793, Dr. Rush states that he had recourse to the use of calomel and jalap in the care of several pregnant women, who were attacked with the fever, and he was so fortunate as not merely to save his patients, but to do it without producing miscarriage. In one of the cases, too, the female had miscarried twice before.

(*c.*) *Climate.*—As a general rule, active cathartics are not borne so well in hot climates as in temperate and cold ones. This is owing no doubt to the greater sensibility of the mucous membrane, rendering this part of the system more liable to active irritation. Dr. Rushenberger, surgeon in the American Navy, remarked during a cruise of the United States frigate Brandywine, in the Pacific Ocean, in 1826, '7, '8, '9, that the soldiers and sailors did not bear the operation of purging as well in the hot latitudes as they did in the cold and temperate ones.* Independently, however, of mere temperature, there appears to be something peculiar in certain regions which modifies the operation of cathartics. Dewar says, "that Egyptians seem to have a great degree of strength in the alimentary canal, as they are difficult to be operated on by medicines. Doses of an

* American Journal of the Medical Sciences. Vol. vi. p. 348.

emetic or of a purgative that would prove highly drastic to the European constitution, pass over their stomachs without effect."* The Parisians, on the other hand, if we are to believe the testimony of the French physicians, bear very badly the use of cathartics. In their fevers, accordingly, they are used with great caution and by some wholly interdicted.

(*d.*) *Habits and Mode of Life.*—All debilitating causes acting continuously upon the system, either in the way of occupation or mode of living, have a direct tendency to impair the capability of the constitution for sustaining the action of powerful cathartics. Dr. Ferriar states that the natives of the manufacturing town of Manchester bear evacuations very badly. In ordering cream of tartar in cases of dropsy, in the Manchester Infirmary, he found that the patients could not bear the same quantities which were prescribed by Dr. Home in the Royal Infirmary of Edinburgh, and that even in giving the ordinary quantity, cordials and tonics were necessary at the same time.† Literary and studious habits, from the derangements of the nervous system which they are apt to induce, have a general tendency to impair the power of the constitution to sustain active purging. In all the cases, however, connected with the mode of life, there is none which so strikingly modifies the effect of cathartics as intemperance. Where this habit has been long persisted in and the system undermined by it, active purging, like bleeding or tartar emetic, not unfrequently produces exhaustion and death. By some the opinion has been entertained that soldiers do not bear purging well. By Mr. Hunter this is contradicted, and he asserts that "few subjects bear free and full purging better than soldiers."‡ Where they do not, it is probably owing more to intemperance than to anything connected with their occupation.

(*e.*) *Frequent Repetition.*—As in the case of all other medicines, this modifies very strikingly the effect of cathartics. In some cases it renders the bowels preternaturally irritable, so that the simplest articles and the smallest doses will excite purging. In others, again, a contrary effect is produced, and a confirmed habit of costiveness induced. In these cases the difference of result depends altogether upon the condition of the intestinal canal, and the precise manner in which the purgation is conducted.§

(*f.*) *The actual condition of the system as to disease.*—This modifies in a most important manner the effect of this class of remedies. In a state of health their effect is different from that in a state of disease. In the former they produce irritation and derangement of the system, in the latter they may remove it. The condition of the vascular system modifies the effect of cathartics. In a full plethoric habit generally they never operate

* P. vi. vii. Larrey states differently, I believe.

† Medical Histories and Reflections. By John Ferriar, M. D.—P. xlv.

‡ Military Surgery.—P. lxxiii.

§ See on this point the admirable views of Hamilton in his work on purgatives, p. 16.

as well as when the system is somewhat reduced. Hence in such cases previous blood-letting always facilitates their operation. Not unfrequently cases are occurring in which after the most active articles fail to move the bowels, they yield immediately on the use of venesection. The state of the intestines, too, greatly modifies their action. In some cases, for example, these organs are so lined with viscid mucus as that the most active agents make no impression at all. The state of the brain and nervous system also greatly modifies the action of these agents. In apoplexy and hydrocephalus, for example, the torpidity of the bowels is so great that the most active cathartics produce little or no effect. Maniacs have been generally snpposed to be in a great measure insusceptible to the action of ordinary cathartics; observations, however, on a large scale have shown this to be erroneous.

Rules to be observed in using Cathartics.—1. Given on an empty stomach cathartics act more efficaciously and are less apt to be rejected.

2. Period of day.—In this respect different articles vary. Some are best given at night, others in the morning.

3. Always dilute with warm gruel as soon as it begins to operate. This allays irritation and promotes secretion.

4. To gain full effect a patient to be kept for twenty-four hours on diluents.

5. Examine the evacuation.

6. Don't be satisfied with giving a purge—see the effect; see that the effect you desired to produce is attained.

Evacuations produced by Cathartics.—These differ greatly in their number, size, and quality, according to the article which may be used. The first evacuations which are passed, generally consist of the matters already existing in the intestines. These are made up of the fæces remaining in the large intestines and the alimentary substances reduced to chyme, which have passed the digestive organs and have had their processes accelerated by the action of the medicine. After this the evacuations assume a different appearance and become more liquid, in consequence of the different fluids secreted into the intestinal canal. The first of these is *serum*, poured out from the exhalants of the inner surface of the intestines; the second is *mucus*, from the mucous follicles; the third is *bile*, from the liver; and the fourth is the *pancreatic juice*. In addition to these are the various kinds of drink which may have been used during the operation; of these various materials are made up the evacuations, differing in the relative proportions of the several ingredients according to the particular medicine used, and the actual condition of the intestines and the system at large. From the character of the evacuations, therefore, it may be inferred what tissues and organs have been particularly acted upon by the medicine.

If they are of a watery appearance, it is proof that the exhalants of the intestinal canal have been excited into increased secretion. If they are mucous, it shows that the mucous follicles have been acted upon. If they are of a bilious character, it is an evidence that increased secretion from the liver has been caused. According to the predominance of either of these secreted fluids, aided by other circumstances, such as the nature of the food which may have been used, &c., the evacuations will be found to differ in their consistency and color. For the purpose of forming a correct opinion in relation to the evacuations, it is important to be familiarized with their appearance in a state of health, as well as the various modifications they may undergo from articles of diet and medicine, as well as from disease.

A perfectly healthy evacuation has a color, consistence, size, and smell peculiar to itself, and which can be better learned from observation than from description. In morbid states of the intestinal canal they assume a great variety of appearances. In affections of the liver they are clay-colored. In dysentery, bloody, mixed with pus, mucus, &c.

Various medicines have the effect of altering the evacuations. The use of *iron* makes them black; *sulphur*, too, darkens them. *Hematoxylon* makes them of a blood-red color. *Senna* gives them a greenish tinge; *calomel*, also, frequently renders them green.

Food and drink, too, greatly vary the appearance of the evacuations. The common vegetable tomato turns them black; spinach makes them green. Claret gives them a peculiar lake tinge.*

THERAPEUTICAL EFFECTS.

VARIOUS MODES IN WHICH CATHARTICS PROVE CURATIVE.—These are various, and, as they lie at the foundation of their use in different diseases, require to be carefully analysed.

(*a.*) *Cathartics prove Curative by simply unloading the Intestinal Canal.*—A constipated state of the bowels, accompanied with an unnatural accumulation of fæcal matter in the large intestines, interferes in a great many ways with the healthy action of the different organs of the human body. Not merely the abdominal organs, but every other part of the system, is directly or indirectly affected by it. To remove this, therefore, in every disease in which it occurs, is, of course, a leading indication; and this is to be accomplished by the use of cathartic agents.

* Mr. Hennen states that "by the use of lamego and other deep-colored wines of Portugal, the stools acquire a tinge almost approaching to black." He adds, "I have known some attempts made to impose upon medical men by persons who have been acquainted with these facts."—Military Surgery, p. 373.

(*b.*) *By making a new and peculiar impression upon the Mucous Membrane of the Intestines, altering existing action and promoting secretion.*—The interruption in the natural secretion of the mucous membrane of the intestinal canal is a constant occurrence in diseased conditions of the system, and the restoration of these secretions is one of the essential means of cure. By the use of appropriate cathartics this is effected.

(*c.*) *By promoting the secretory function of the Liver.*—In a great variety of diseases the liver becomes disordered in its functions. Not merely the quantity of bile is lessened, but the character of it is very much changed from its natural and healthy state. Among the means calculated to correct this condition of the liver, cathartics, and especially calomel, are the prominent agents.

(*d.*) *By creating a new action in the Intestines, and keeping up a determination of fluids to this part, and thus relieving other parts of the system; by transferring action from one part of the system to another.*—In this way cathartics act upon the principle of revulsion or counter-irritation, and they thus prove eminently beneficial in a great number and variety of affections. To produce this effect in the most decided degree, the purgation should be continued for a suitable length of time, and such cathartics selected as are capable of producing a decided impression upon the intestinal canal. In this way almost every organ and tissue in the body may be indirectly influenced by cathartics.

(*e.*) *By acting as simple evacuants, and in this way lessening the quantity of circulating fluids, and improving the action of the Heart and Arteries.*—The cathartics best calculated to produce this effect are those which act powerfully on the exhalants of the intestinal canal, and cause copious watery evacuations. The amount of effect which they are capable of producing in this way must appear obvious, if we reflect for a moment on the extent of surface upon which they act, and the quantity of fluid which may be drained from the system through their agency.

(*f.*) *By equalizing the Circulation.*—This effect may be produced in two ways, according to the cause producing the unequal distribution of blood. In some cases, this may be owing to the pressure of the overloaded and distended intestines upon the large blood-vessels of the abdomen, which thus mechanically interferes with the circulation in those vessels, and as a consequence causes congestion about the head and chest. Cathartics, by simply unloading the intestines, remove the pressure, and thus relieve the obstructed circulation. In other cases, the unequal distribution of blood may be owing to undue accumulations in particular parts, in consequence of inflammation or congestion. Cathartics, by exciting an action in the intestinal canal, and making it a new centre of afflux for the fluids of the system, divert from other parts, and thus equalize the circulation.

OF THE USE OF CATHARTICS IN PARTICULAR DISEASES.

There is no class of medicinal agents more generally resorted to, or more really useful, than cathartics, if used with due discretion. To a certain extent, they may be rendered available in almost every disease to which the system is exposed. The very fact, however, of their being so generally useful, renders them liable to be abused. One would suppose that the opinion was entertained by many that purging could never do harm, but was always attended by beneficial consequences. Hence they appear to be prescribed almost as a matter of course, without much regard to the existing state of the system, or of the important effects which these agents produce. That this statement is by no means exaggerated must be apparent to every competent and attentive observer, and it shows the necessity of establishing, if possible, some of the leading facts and fundamental principles by which the use of these agents may be regulated. This I shall attempt in the following remarks.

I. *Of Fevers.*—Without entering into any discussion on the nature of fever, it is only necessary to notice some of the prominent phenomena attending it, for the purpose of elucidating the principles upon which cathartics are used.

1. In fever, it is generally observed that the natural peristaltic motion of the bowels is impaired. Hence costiveness is a prominent symptom, and the contents of the intestinal canal are retained a much longer period than they should be—and being so retained, they necessarily act as a cause of irritation, and thus increase the general febrile symptoms.

2. It is observed in fever that the function of the mucous lining of the intestines becomes disordered. Hence, the secretions of this surface are lessened in quantity and altered in character—in some cases becoming highly vitiated and unnatural in their apppearance.

3. It is observed that the functions of the liver are frequently disordered, and the liver itself congested. The quantity of bile is greatly diminished, and frequently much altered in its character.

4. The abdominal viscera are generally more or less crowded with blood, and their secretory functions more or less impaired. Now to obviate and correct these conditions of the abdominal organs, cathartics are the remedies resorted to, and they operate in the following manner. They evacuate the contents accumulated in the intestines—they promote the secretions of the mucous lining of the intestines—they excite the liver and promote the secretion of bile—and lastly, they aid in restoring the secretions of the other abdominal viscera. In consequence of these local effects, others of a general nature ensue. The circulation becomes more free and uniform, the blood is more equally distributed, and general excitement is diminished.

In endeavoring to accomplish the foregoing objects by means of cathartics there are two things specially to be regarded. One of these is the *proper selection of cathartics*, the other is the *particular condition of the mucous lining of the intestinal canal.* It has already been stated that cathartics differ greatly from one another; some act mildly, while others produce great local irritation; some promote secretion, while others are in a great measure destitute of this power. Now the cathartics which are required in fever are such as will evacuate the bowels and act by restoring abdominal secretion, and at the same time produce as little local irritation as possible. All drastic cathartics are therefore improper. As a general rule, they have a tendency to create local inflammation of the intestines and in this way aggravate the general febrile commotion. Among the cathartics best suited to fever, calomel, to begin with, takes the lead. It promotes in a manner peculiar to itself hepatic and intestinal secretion, while it produces little or no local irritation. As an adjunct to calomel, castor oil is invaluable. It evacuates most thoroughly the contents of the bowels and has a tendency to allay irritation. In addition to these, the saline cathartics, jalap, rhubarb, and magnesia may be used with safety and advantage.

With regard to the condition of the mucous lining of the intestines it is to be recollected that in fever it is frequently the seat of inflammation, and when this is the case, active purging ought to be avoided. Even this, however, should not preclude the occasional use of calomel, and the regular evacuation by mild means. As fevers differ in their phenomena, the use of cathartics as well as of all other agents must evidently be very much modified by this circumstance. For the purpose of illustrating this let us notice briefly the more striking varieties of fever.

(*a*). *Intermittent Fever.*—The essential means of cure in this form of fever are tonics of various kinds, administered during the intermission, with the view of preventing the return of the paroxysms. For the safe and effective use of these agents, however, the system must be properly prepared, and among the agents used for this purpose, cathartics are the most efficient. The reasons of this will be apparent from the following considerations. From the nature of the convulsion through which the system goes during a paroxysm of this form of fever, it is evident that a congestion of blood must take place in the abdominal viscera. The necessary consequence of such congestion is a derangement of function in the parts concerned, showing itself in disordered action of the stomach, liver, and bowels. Hence the tongue is furred, the stomach is nauseated, and the bowels constipated. In the collapse of the system which takes place during the sweating stage, although the congestion is partially and sometimes entirely relieved, yet this disordered condition of the digestive organs remains behind to a greater or less degree. Now, if in this state of things tonics be at once resorted to, it will be found not merely that they are

uncertain in their effects, but they frequently render permanent the periodical congestions which take place during the paroxysms. To obviate all this, suitable preliminary evacuation is required. The best cathartics for this purpose are such as will promote hepatic and intestinal secretion without producing much irritation. The best articles to accomplish these objects are calomel followed by castor oil, or calomel and jalap in combination. In ordinary cases, and when the disease is taken in its commencement, a single cathartic will answer every purpose. When, however, the paroxysms have been continued for some time, where there is great bilious derangement, fulness of the abdomen, foul tongue, &c., repeated purgation may be necessary before tonics will produce their effects.

In intermittent fever, then, cathartics are to be considered merely as preliminary agents to bring the system, and especially the digestive organs, into a condition appropriate to the use of tonics.

The best period for giving cathartics is during the intermission.

(*b*). *Remittent Fever.*—Here the use of cathartics is still more imperatively called for. In this form of fever, the congestions of the abdominal viscera are of a more permanent character than the intermittent. In consequence of this the functional derangements of the liver, stomach, and intestines are more marked, and it is for the improvement and correction of these that cathartics are so essential, and they must be repeated according to circumstances until these objects are accomplished. The articles most useful here are calomel followed by castor oil, calomel and jalap, the saline cathartics, and magnesia. In this form of fever, inflammation of the stomach and bowels is not an uncommon occurrence, and when this is the case, all active cathartics should be avoided.

Continued Fever.—Cathartics are no less important than in the preceding forms of fever, and they act by restoring intestinal and hepatic secretion, moderating general excitement, and where the head is much affected, exercising a salutary revulsion upon the bowels. As fevers of this kind differ materially, the kind of cathartics and the degree of purgation must be determined by existing circumstances. Where the liver is particularly implicated, calomel is an article never to be overlooked. Where the head is affected, such articles as are calculated to produce a decidedly revulsive effect may be used, such for example as jalap and cream of tartar. In these cases too, more free purging will be required and prove beneficial.

In the use of cathartics, the period ought to be specially considered. In the commencement, purges of an active nature may be required, while as it advances and especially towards the latter period such milder articles are only to be used as will evacuate the bowels without producing irritation on the one hand or debility on the other.

From the foregoing, it must appear evident that cathartics are agents of great value in fever generally. At the same time, it is recollected that in their practical application great abuses have arisen and much injury

is constantly done. This has probably arisen from attaching to them an importance somewhat exaggerated. They are accordingly, by many, relied upon almost exclusively in the cure of fever, and the most active purges are repeated from day to day throughout the disease, with the most unceasing and relentless assiduity. The considerations which have already been offered, must convince any reflecting person that such practice is irrational and attended with danger. Besides, it should be recollected, that fever is a disease affecting the whole system—all the functions are disordered and all the secretions are more less prevented. Now, cathartics are only one of the means of cure, and, although some mild cases of fever may yield to them alone, yet more aggravated forms of it are not to be managed by exclusive attention to the bowels. Important as this is, the other secretions, especially that of the skin, require equal attention. If this important fact was constantly borne in mind, it would tend to limit the use of cathartics within their proper bounds and obviate much of the evil resulting from their use.

The great objects then to be gained by the use of cathartics, in fever, are :—

1st, To relieve congestion of the abdominal organs.

2d, To restore secretion—in both these ways they prepare the system for the use of tonics.

The evils they may, if injudiciously used, produce are :—

1st, They may produce irritation, or inflammation.

2d, They may produce too much debility.

Inflammation.—I come next to consider the use of cathartics in the various forms of inflammation. The principles upon which they may be rendered available, are the following.

1. In all cases of inflammation, the functions of the system become more or less disturbed, and among these none more so than those of the intestinal canal. Hence, costiveness is a frequent attendant in these cases. The intestines being thus unnaturally overloaded, the general irritation of the system is increased, and as a consequence the local irritation is aggravated.

Again, in all cases of inflammation, in consequence of the general disturbance of the system, the functions of the mucous lining of the intestines are deranged. The natural action of the secretory vessels of this tissue is impaired, and in consequence of this the general excitement is increased and thus the local inflammation aggravated.

To obviate these conditions of the intestines, cathartics of various kinds are used and with the greatest advantage. By keeping the bowels continually in a free state they remove a constant source of irritation; at the same time, by the impression which they make on the mucous membrane, they restore the natural secretions of the part. In this way, general excitement is directly lessened and indirectly the local inflammation

moderated. This is one mode in which cathartics are rendered beneficial in inflammation.

2. Cathartics, some more and some less, deplete all the organs and tissues upon which they operate, and in this way by the evacuations which they produce, lower excitement and thus prove useful.

3. Another mode in which cathartics prove beneficial in many cases of inflammation, is by the new action which they create in the intestinal canal, operating on the principle of revulsions.

For the purpose of illustrating the foregoing, let us notice briefly inflammation as it assails different parts of the body.

(*a.*) *Inflammation of the Brain.*—In all inflammations affecting this organ, there can be no question as to the utility of cathartics. Theory sanctions, and experience confirms it. In all cases of this kind, there is a general tendency to torpor of the bowels. In consequence of this, accumulations are apt to occur in them; and by their distension and pressure on the surrounding organs and large blood-vessels, they crowd the blood unnaturally towards the upper part of the body. By the judicious use of cathartics this is obviated. But they operate still further and more decidedly. They create a determination to the abdominal viscera, and they relieve the brain, upon the principle of revulsion. From the inactivity of the bowels generally attending these cases, such articles will be required as act efficiently and free. Among these, calomel, jalap, senna, salts, and in some cases croton oil, are most to be relied on. To produce their full revulsive effect, it is necessary that their action should be kept up for a considerable length of time. For this purpose they should be repeated from day to day, according to circumstances.

Trachitis.—In this disease, cathartics may be used with advantage as auxiliary to other remedies. In the selection of the cathartic, the preference should be given to calomel. Besides operating most efficiently on the liver and intestinal canal, this article possesses the additional advantage of extending its sympathetic action to the inflamed membrane—promoting the secretions of the part and lessening general excitement. To obtain the best effects of this article it should be given in full doses and repeated at suitable intervals. As an adjunct, castor oil is the best article that can be used.

Inflammation of the Lungs.—The propriety of having recourse to cathartics in this form of disease, has been made a question by some eminent authorities. Among the objections urged against their use, the most common and forcible is that they interfere with expectoration and perspiration, both of which are looked upon, and justly so, as processes exceedingly important in the solution of thoracic inflammations.

To a certain extent this objection is founded in truth. That active purging does have a tendency to check expectoration is certainly true; and if it be resorted to when this is freely going on, there is no doubt that it

may prove injurious. It is to be recollected, however, that expectoration only commences at a certain period of the inflammation, and the use of cathartics antecedently to this period can be no more objectionable than venesection or any other antiphlogistic remedy. With regard to perspiration it is to be remarked, that in inflammation of the lungs, as in all other inflammations, this process never takes place, at least to any salutary extent, while the general excitement of the system is above a certain standard. It is only when this is properly subdued that the skin becomes free and perspirable. Purging, therefore, in the early periods of the disease, by lessening excitement, rather favors than otherwise the subsequent process of perspiration. In the early stages of thoracic inflammation, therefore, purgatives are not merely innocent, but may be made exceedingly valuable auxiliaries; and they operate both by lessening general excitement and producing a revulsive action upon the intestinal canal. When, however, the inflammation is coming to a regular crisis, when the skin is soft and moist, and the secretions from the mucous membranes of the lungs, free, active purging should be avoided. This is the practical distinction to be observed in these cases. The cathartics best suited here are calomel, castor oil, and the neutral salts.

Inflammation of the Abdomen.—In almost every case of this kind, cathartics may be used with advantage. In the selection of cathartics, however, and in the extent to which the purgation ought to be carried, there will be found a great difference, according to the particular tissue or organ which may be the seat of inflammation. This will be best illustrated by noticing in detail a few of the more important.

Inflammation of the Mucous Membrane of the Stomach.—This may exist either in the acute or the chronic form, and in both suitable evacuation of the bowels is a point of great importance. In relation to this practice, I am aware that a great difference of opinion exists. The propriety of it, however, appears to me to rest upon various considerations. In the first place, should the fæces be suffered to accumulate in the large intestines, the mere pressure upon the stomach which the distension of these organs would occasion would have a direct tendency to increase the gastric irritation. In the second place, undue accumulations in the large intestines would have the effect of creating irritation in the mucous membrane of these organs, which might be extended, sympathetically, to the mucous membrane of the stomach. To remove, therefore, all cause of irritation from this source, it is essential that the large intestines should be kept freely evacuated. In the mode of doing this, however, certain precautions are to be attended to. As a general rule, it is not to be accomplished by the introduction of cathartics into the stomach. In the irritable condition in which the stomach generally is in these cases, ordinary purgatives will be very apt to be rejected, and therefore will prove useless. In addition to this, if they are articles of an active character, even should they

be retained, they will be apt to act as local irritants, and thus aggravate the inflammation. On these accounts, active enemata, repeated at suitable intervals, are to be preferred in these cases. To all this, however, there is an exception to be made in favor of one cathartic—and that is calomel. This article does not act as a local irritant. Even where it comes in contact with inflamed surfaces, so far from increasing inflammation, it frequently has the effect of allaying it. From its small bulk, also, it can readily be taken, and is retained on the stomach when every other article is rejected. Calomel, therefore, is a remedy which may be used without any danger of increasing irritation; and, at the same time, by its antiphlogistic operation on the irritated surface, and its purgative action on the liver and bowels, may prove eminently beneficial.

Inflammation of the Mucous Membrane of the Bowels.—Cathartics here may be used upon the same principles as in inflammation of the stomach. To keep the bowels properly evacuated is essential. This, however, is to be accomplished by the mildest means. All active, and especially drastic cathartics prove injurious. The best articles to be used are calomel and castor oil.

Inflammation of the Serous Membrane of the Abdomen.—In this form of inflammation, considerable difference of opinion exists with regard to the use of cathartics. By some they are considered as highly injurious. This opinion does not, however, appear to be well founded. In cases of peritonæal inflammation the bowels are generally costive; and where this is the case, it must necessarily add to the existing inflammation. By the use of cathartics, this is obviated. Besides, where the mucous membrane is free of disease, copious secretion may be produced from this surface by the use of appropriate cathartics, and in this way, may aid very powerfully in relieving the peritonæal inflammation.

Inflammation of the Liver.—With regard to the use of cathartics in this form of inflammation, there is in American and British practice very little difference of opinion. By the French, and especially the followers of Broussais, they are reprobated. Their objections go upon the supposition that purgatives are all irritating in their nature. That some purgatives are so is unquestionably true, and these ought certainly to be avoided. Every active cathartic, however, is not of this character. Calomel and castor oil are not so, and these may be used with perfect impunity so far as any irritation which they occasion is concerned—and so far from being injurious, their use is sanctioned both by theory and experience. After the free use of the lancet, there is no remedy so salutary as a large dose of calomel, followed by castor oil and some of the saline cathartics. Should these act freely on the bowels, they relieve the oppression and fulness about the region of the liver, and at the same time aid in subduing inflammation; and they operate by the free secretion which they produce from the liver and the mucous membrane of the intestines, acting both as evacuants and

revulsives. When tardy in their operation, they should be aided by the use of enemata.

Inflammation of the Kidneys and Bladder.—In both mild cathartics may be used with advantage. They relieve the inflamed organs from the pressure resulting from an overloaded state of the bowels and at the same time act beneficially as evacuants. From the sympathies existing between the kidneys and bladder and the rectum, all such cathartics as are apt to produce irritation in the latter organ should be avoided. Some cathartics, too, have a tendency to pass off by the urinary organs, and when this is the case they add to the existing inflammation. Upon this principle, the saline cathartics are objectionable.

INFLAMMATION OF THE FIBROUS SYSTEM.

Rheumatism.—In the acute form of this disease, cathartics are remedies of great value and they prove beneficial in the first place, as evacuants, by diminishing general excitement, and in the second place, as revulsives in keeping up a determination to the bowels. The best articles to be used are an occasional dose of calomel, followed by the saline cathartics, or what is better, a combination of rhubarb and magnesia.

Gout.—Here, cathartics are no less needful. Everything connected with this disease shows how intimately it is associated with disorders of the digestive organs. From the slow and continued operation of various causes, the secretions of the liver and bowels become vitiated—there is costiveness and acidity—the bowels become loaded with mucus, and a general debility of the whole abdominal system ensues. On this condition of things free evacuation of the alimentary canal and a constant and pretty powerful impression on it cannot fail to do good.

Dropsies.—There is perhaps no class of diseases in which the use of cathartics has been so generally concurred in as in dropsies, and there can be no question with regard to their general utility. Notwithstanding this, they are not to be given indiscriminately. For the purpose of understanding the principles upon which they are to be used and the extent to which they may be carried, it is necessary to have in mind correct notions of the disease for which they are prescribed. By dropsy, in the ordinary acceptation of the term, is meant nothing more than the accumulation of fluids in different parts of the body. This, however, conveys a very imperfect idea of the real nature of the affection. This accumulation of fluids is a mere effect or consequence of some deranged condition of the system at large, and more especially of the capillaries, the vessels concerned in excreting and absorbing the fluids; in many cases indeed this excretion of fluid ought to be regarded as a true curative effort of nature to rid the vessels of the undue amount of fluid they contain.—*Bird.*

In the management, therefore, of dropsies, the great object is not so much to evacuate the fluid which may be accumulated as it is to correct that condition of the constitution and of the tissues immediately concerned, upon which the dropsical effusion depends, and so far as cathartics aid in doing this, they may be useful. Where dropsies depend upon inflammatory conditions of the system and of the tissues which secrete the fluid, as they are now known to do in a large proportion of cases, cathartics are remedies of marked utility, and they produce their effects in three different ways. 1st. By lessening excitement. 2d, By transferring action and secretion to the intestines, upon the principle of revulsion. 3d, By promoting absorption. On the other hand, where dropsies are associated with general debility and where the digestive organs are much enfeebled, they should be used with caution. No practice can be more irrational than that of persisting in the use of these agents under such circumstances. The dropsical effusion not unfrequently is increased instead of being lessened. Even where this latter effect is accomplished, it is only temporary—the fluid accumulating almost as rapidly as it is evacuated.

To keep up the effect, a constant repetition of the remedy is rendered necessary, and in this way more harm than good is often done. In the vain attempt to evacuate the fluid, the deranged condition of the constitution and of the tissues, upon which the whole depends, is overlooked, and the patient finally sinks under the combined effects of the disease and the debility induced by the remedy.

Where there is any tendency to intestinal irritation, cathartics should be used with caution and the more active ones wholly abstained from. Although useful to a certain extent in all the forms of dropsy, cathartics are more especially so in ascites. In hydrothorax, active purging does little good and sometimes does harm.—*Blackall*, p. 192.

Another class of cases of dropsy in which cathartics are useful, is where the effusion depends on any obstruction in the portal circulation, as from diseased liver, preventing the arrival at the kidneys of a due amount of fluid, and in this way less urine is secreted. Here, the kidneys being prevented from performing their duty, we must impose that duty on the exhalants of the intestines, and to stimulate them to it, we give hydragogue cathartics. That they are capable of acting in this way vicariously for the kidneys is proved by the fact that under such circumstances urea has been detected in the fluid stools procured by elaterium.—*Bird.*

The cathartics best suited to dropsical cases are those which are of a hydragogue character. Among these, however, there is a great range, some acting mildly and others more powerfully. The selection of the individual article must be determined by the particular character of the case. When fever and inflammatory action are present, all drastics ought to be avoided, and the best articles are jalap and cream of tartar in combination; and the neutral salts or senna and salts in cases where no

febrile symptoms are present. Where there is no intestinal irritation or derangement, and where the patient has sufficient constitutional vigor to bear their action, the more powerful hydragogues may be used, and frequently with good effect. Among these the best are gamboge, elaterium, and croton oil.

CLASSIFICATION OF CATHARTICS.

Cathartics may be advantageously classified, according to the effects which they produce, into the three following divisions.

1. Those which operate principally by increasing the natural peristaltic action of the intestines, causing little or no increase of secretion from the mucous lining of these organs. As a general rule they produce their effects with great mildness, and their operation is limited in a great measure to evacuating the existing contents of the bowels. To this division belong the whole class of what are usually called *Laxatives.* Under this head may be ranged, *castor oil, magnesia, sulphur, manna, purging cassia, tamarinds, rhubarb and aloes, charcoal.*

2. Those which, in addition to increasing the natural peristaltic motion, act by stimulating powerfully the exhalant vessels of the mucous lining of the intestines, and thus causing free secretion from them. Besides unloading the bowels, these produce watery evacuations. In the degree of activity in the articles of this class there is a good deal of difference, some operating very mildly, while others produce considerable irritation. To this division belong the whole class of *hydragogue cathartics.* Under this may be placed the *neutral salts, jalap, May apple, senna, scammony, gamboge, supertartrate of potass, colocynth, elaterium, croton oil.*

3. Those which, in addition to increasing the natural peristaltic motion, act by exciting the mucous follicles of the intestinal canal, and at the same time extend their influence to the liver. The evacuations produced by this class are mucous and bilious. To this belong *calomel* and the *blue pill.* Other cathartics act also on the liver, especially the drastic ones, but not in the way calomel does; calomel produces its effect mildly—the others by irritation.

INDIVIDUAL CATHARTICS.

CASTOR OIL.

The plant which yields this valuable article is the *Ricinus communis,* so called from the seeds of it resembling in shape and color the insect called *ricinus* (the tick). It grows in great abundance in

almost every part of the East Indies, where it is native. It is also a native of Africa. In the West Indies, in various parts of Europe, but more especially in the southern part of the United States, it is extensively cultivated. It is an annual plant of very speedy growth, from four to six feet high. In the warmer climates it sometimes attains the height of eight, ten, twenty, and even thirty feet.—(Ray, Roxburg.) The oil used in medicine is obtained from the *seeds*. These are inclosed in rough capsules, which are about the size of a large marble, of a pale green color, and covered with flexible prickles. Each of the capsules contains three seeds, which are expelled by the bursting of the capsules. The *seeds* are of an oval shape and of the size of a small bean, a quarter to one third of an inch long, of a pale greyish color, marbled with yellowish brown spots and veins. When the external coat is taken off, it leaves a kernel of a white color, which has a sweetish, oily, and somewhat nauseous taste. In their action on the system, the seeds are acrid and irritating; three or four of them prove actively emetic and cathartic.

Modes of preparing the oil.—These are different in different countries.

1. *By Decoction.*—This is the mode practised in the West Indies. The seeds are first decorticated and bruised in wooden mortars, and then boiled with water for about two hours, in a large iron boiler, stirring it all the time. The oil now separates and floats on the surface, mixed with a white froth. This is then skimmed off and the skimmings are heated in an iron vessel, and then strained. When cold, it is put into jars or bottles, and is fit for use. Sometimes, the seeds are first roasted, for the purpose of increasing the quantity of oil.

This mode of preparing the oil is liable to several objections. If the seeds be roasted, the oil becomes of a brownish color, while the process renders it acrid and irritating.

2. *By Expression.*—This consists in simply subjecting the shelled seeds to pressure, by which means the oil is separated. When this is done without the agency of heat, the oil is called *cold pressed oil.* In France, the mode of doing this is, first, to shell the seeds and then subject them to a strong press. The oil is then suffered to stand for a certain time, for the purpose of separating the mucilage, which precipitates. After this the oil is strained. In this way, the oil obtained is about one third of the weight of the seeds employed.

In the United States, where this oil is manufactured very extensively, the process is the following:—The seeds, after being well cleansed, are put into a shallow iron receiver, where they are subjected to a very gentle heat, for the purpose of rendering the oil sufficiently liquid for easy expression. They are then put into a powerful screw press, by which a whitish oily liquid is obtained. This is then put into clean iron boilers, mixed with water and boiled. During the boiling, the impurities which rise to the surface are skimmed off, until, at last, a pure oil is left on the surface of

the water. The clear oil is now carefully separated, "and the process is completed by boiling it with a minute proportion of water, and continuing the application of heat, till aqueous vapor ceases to rise, and till a small portion of the liquid, taken out in a vial, preserves a perfect transparency when it cools. The effect of this last operation is to clarify the oil and to render it less irritating by driving off the acrid volatile matter." If the heat employed be too great the oil becomes of a brownish color, and of an acrid taste. Great care, therefore, is necessary in regulating the degree of heat. Good seeds, by this process, yield about twenty-five per cent. of oil.

3. *By Alcohol.* This is another mode recently suggested in France, and is founded on the solubility of castor oil in alcohol. It consists in macerating the kernels, made into a paste, in cold alcohol. In this way ℥vi. of oil are extracted from a pound of the seeds.

The mode of preparing castor oil is a matter of much practical importance, inasmuch as it modifies its qualities and effects. It has already been stated that the seeds are exceedingly irritating, and the same is sometimes the case with the oil. What the cause of this may be, is a point which has given rise to a difference of opinion. By some it is supposed to be owing to an acrid principle residing in the seeds, while by others it has been attributed to the employment of heat in the preparation.

With regard to the acrid principle, some suppose it to reside in the *shells*, while others locate it in the *embryo*. According to Guibourt, however, the shells contain none of it; and the only effect which they can have is to color the oil. Nor does it reside exclusively in the embryo. The truth is, the whole kernel appears to contain a volatile acrid principle. By boiling in water this principle is carried off, and a bland and almost colorless oil is obtained.

With regard to the agency of heat, it appears that too great a degree of heat, or too long continued, changes the nature of the oily principle itself; in consequence of which it becomes deeper colored and acrid.

From the foregoing it would seem: 1. That the removal of the shells is not necessary. 2. That the great point is the proper graduation of the heat.

The mode adopted in this country, therefore, is accordant with the above facts.

Properties.—Castor oil is a thick, viscid fluid; little or no smell; a mild and somewhat nauseous taste, leaving behind it a slight sensation of acrimony in the throat. When pure, it is colorless. Generally, however, of a light straw color.

When prepared by decoction, or when the degree of heat has been too great, it is of a brownish color, and has a hot and acrid taste. When exposed to the air, it becomes thick and rancid, without becoming opaque.

Composition.—When distilled, castor oil yields besides a little gas, water, and acetic acid—

1. A colorless, odorous, volatile oil.

2. Two fatty acids. The *Ricinic* and *Oleo-Ricinic*, or *Elaiodic*. Both excessively acrid.

3. A residual solid matter of a peculiar character.

The volatile oil and the acids make up about one third, while the residual matter makes up the remaining two thirds.

Castor oil possesses the general properties of the fixed oils, except that it is wholly soluble in alcohol and ether. Diluted alcohol dissolves about two thirds.

Purity.—Sometimes adulterated with more common oils. This is tested by its solubility in alcohol. If castor oil be genuine, by adding to it an equal quantity of alcohol of sp. gr. of ·820, a *uniform solution* will be made. On the contrary, if it form a milky mixture or any portion remain undissolved, an adulteration with some of the more common fixed oils may be suspected.

Effects.—As a cathartic it possesses many valuable properties. It operates gently, yet efficaciously. While it thoroughly evacuates the intestines, it causes no griping or pain. The number of evacuations caused by a single dose seldom exceeds two or three. Besides operating mildly, it produces its effects with more rapidity than most other cathartics. It frequently acts in a couple of hours, and seldom takes longer than three or four.

Another peculiarity attending its operation was remarked by Dr. Cullen. He states that if it be frequently repeated, the same effect will be produced by diminished doses.

Generally speaking, the oil may be recognised in the evacuations, sometimes appearing in masses, and in one case mentioned by Pereira in the form of nodules, like biliary concretions.

From the peculiar operation of this article it is an exceedingly valuable cathartic and well calculated to fulfil many indications which no other can accomplish. It is adapted to all cases, when the object is to evacuate the bowels freely, without causing any irritation, and without producing alvine secretion. It is admirably well adapted to follow the use of mercurial cathartics, of which it insures the operation without altering the effects. For this purpose it is superior to any other cathartic. For children it is a peculiarly safe and good laxative.

In some cases, an objection to its use is that it leaves the bowels costive. In other cases this is an advantage.

Mode of administration and dose.—For adult, ℥j; child, ʒj to ʒij.

1. *Simple.* Thinned by heat. Best form of giving it.
2. Mixed with syrup or sugar.
3. Hot coffee or milk.
4. Emulsion, with yolk of egg and sugar.
5. Floating on spirit.

MAGNESIA.

Magnesia is used in medicine in three different forms—*magnesia, carbonate of magnesia*, and *sulphate of magnesia*. At present the two first are only to be considered.

1. Magnesia.—From the manner in which it is prepared, commonly called *magnesia usta* or *calcinata*.

It is prepared by subjecting the carbonate of magnesia in a crucible to a red heat for about two hours, or until no effervescence is produced on the addition of diluted acetic acid. During this process, the water and carbonic acid are driven off and the pure magnesia left. When cool, it is to be put into tightly stopped bottles.

Composition.—One eq. magnesium = 12, one eq. ox. 8 = 20.

Properties.—In the form of a white powder, without smell, and if perfectly pure without taste. It is very light, its specific gravity being 2·3. It is very sparingly soluble in water—more so in *cold* than in *hot*. According to Dr. Fyfe, it requires 5,142 parts of cold water and 36,000 parts of hot to dissolve it. With acids it does not effervesce. By exposure to the atmosphere, it slowly attracts carbonic acid and is converted into the carbonate. Hence the necessity of keeping it in tight bottles.

Purity.—The most common adulteration is the admixture of *carbonate of magnesia*. This is ascertained by adding to it a little diluted hydrochloric acid. The best way is to mix a little of the magnesia in water and then add a few drops of acid. If pure, it should not effervesce.

Sometimes it contains *lime*, either added fraudulently, or obtained from the carbonate, from which it has been prepared. This may be ascertained by dissolving the magnesia in hydrochloric acid, neutralize the acid solution with ammonia, dilute it with water, and add to it a solution of oxalate of ammonia. If there is a white precipitate, it shows the presence of lime. Domestic Chemistry, p. 173.

2. Carbonate of Magnesia, commonly known by the names of *magnesia alba* and *sub-carbonate of magnesia*. In Hindostan and some parts of this country it is found native. What is used in medicine is prepared artificially.

The mode of preparing this is to add together separate solutions of *sulphate of magnesia* and *carbonate of potash or soda*—boil the mixture for a short time, stirring it all the while. On standing, the carbonate of magnesia is precipitated, while the sulphate of potash or soda is held in solution. The liquor is then to be poured off and the precipitated powder to be well washed with boiling distilled water and dried. The washing

separates whatever of the sulphate of potash or soda may remain in combination with it. Sometimes it is dried in wooden moulds, in consequence of which it has the square form in which it is found in the market.

Another mode of preparing it is from the *bittern*, or liquor which remains after the crystallization of salt from sea water. The bittern consists chiefly of *muriate and sulphate of magnesia*. This is heated to 212° and a solution of carbonate of potash is added. The same process is then gone through as before.

In the United States this article is extensively manufactured, particularly at Boston and Baltimore.

Composition.—According to Berzelius, 100 parts consist of magnesia, 44·75; carbonic acid, 35·77; water, 19·48.

Properties.—Carbonate of magnesia, as found in the shops, is either in powder or square masses. It is perfectly white, tasteless, and without smell; very light (48 grs. fill an ounce measure, Pereira). It is nearly insoluble in water, requiring 2,473 parts of cold, and 9,000 parts of boiling water to dissolve it. It is, therefore, more soluble in cold than in hot water. In carbonic acid water, readily soluble—unaffected by exposure to the atmosphere—effervesces with acid, and is decomposed by a strong heat.

Impurities and Adulterations.—Magnesia frequently contains carbonate of lime (chalk), sometimes added fraudulently, sometimes arising from the presence of calcareous salts in the compounds employed in the preparation of magnesia.

Effects.—Magnesia, either in the state of calcination or of the carbonate, is a gentle laxative. From its great affinity for acids, it readily unites with these in the intestinal canal, and when it meets with enough of those existing there (the acetic and muriatic), it forms acetate and muriate of magnesia, both soluble salts, and thus its activity is increased. From the fact of its thus uniting with and neutralizing acids, it acts powerfully in allaying gastric and intestinal irritation. Besides this, magnesia is supposed to act still further in allaying irritation by being mechanically applied to the nervous extremities of the mucous membrane of the intestines.

As a cathartic, then, this article is peculiar, and it is indicated where acidity and disordered secretion of the stomach and bowels are present. For children it is an invaluable agent. It corrects acidity, allays irritation, and operates with sufficient activity as a cathartic. It does not generally produce any serous evacuations unless the quantity of acid with which it meets is very great. It generally renders the evacuations of a lighter color. The calcined magnesia is preferable to the carbonate, because in the latter so much carbonic acid gas is extricated as frequently to cause painful distension of the intestines. Magnesia, when used for a long while, sometimes accumulates in the bowels in solid, hard masses, concreted

by intestinal mucus, and they may cause mischievous irritation. A mass of this sort weighing from four to six pounds was found in the colon.*

Dose.—Of the carbonate for an adult, from ℈i to ʒij; a child from 2 to 10 grs. Calcined magnesia somewhat less. It may be given in milk or water intimately mixed. If a glass of lemonade be taken immediately after the magnesia is swallowed its efficacy as a cathartic is increased. Of course its power as an antacid is diminished. Where flatulence is dreaded give the alkali in mint or anise water.

SULPHUR.

This substance is extensively diffused throughout the mineral, the vegetable, and the animal kingdom. It is found native and in combination either in sulphuret or in the state of sulphuric acid. When native it is found either in masses or crystallized. Native sulphur is found most abundantly in volcanic countries, and the great mass of what we use in the arts and in medicine comes from the south of Italy where it abounds. The sulphur of commerce is procured chiefly by distillation from the native sulphur, though in some parts of Europe it is obtained from the sulphuret by strong heat. Sulphur is found in the shops in two states. In rolls—the roll brimstone of commerce, and in fine powder, the flowers of sulphur. Of each of these there are, or at least were, two varieties; for roll brimstone was formerly prepared by simply melting the crude sulphur, when the impurity being allowed to subside, the pure sulphur was poured off and received into moulds. Now, however, the roll sulphur is usually prepared by distillation, the product being afterwards melted and run into moulds. If the product of distillation be received into a large sulphur chamber, it is deposited upon the walls in the form of fine powder. This is the common flowers of sulphur. And if this be afterwards carefully washed till the water no longer stains litmus, it is the sulphur lotum—the washed sulphur of the shops.

Properties.—An elementary body of a pale yellow color, permanent in the air. When in rolls or masses it is crystalline or amorphous. It has little smell unless rubbed, and no taste; is a bad conductor of electricity; it is perfectly volatilizable—fuses at 400°.

Effects.—In doses of from one to three drachms sulphur acts as a mild evacuant of the alimentary canal, causing little irritation, and having scarce any effect on the secretions. It is a good remedy where a purgative is wanted, and yet some diseases of the rectum, as stricture, prolapsus ani, or hemorrhoids, render the irritating effect of ordinary purgatives objectiona-

* Pereira sub Voce.

ble. To render it more prompt and certain it is often combined with cream of tartar, and less frequently with magnesia.

Dose as a purgative ʒi to ʒiij.

MANNA.

This, though long supposed to be generated in the atmosphere, is now known to be the concrete juice of a tree native of Sicily and Calabria. The precise botanical origin of manna is still matter of dispute, but the better opinion seems to be that it comes from one or more species of ornus, a genus detached from the genus of Fraxinus. Prof. Gasson asserts that it comes from the Ornus rotundifolia, though the common opinion is that the species Europea furnishes it. Manna is obtained by making slight incisions in the bark, though some of it flows spontaneously. The juice appears first as a clear viscid fluid, but soon concretes in the shape of ridges or stalactites. The manna harvest begins in July and continues till October. There are many varieties which seem to depend on the season and mode of collection. Of these the *flake manna* is the best. It comes in pieces from one to six inches long, bright, brittle, dry, white or yellowish white, hollowed in the side to which it has adhered to the tree. It has a faint odor and a sweet, though somewhat sharp peculiar taste.

Manna in sorts.—This is a common kind, and seems to be a mixture of the flake with the fatty manna. It is in smaller pieces, pale brown, not flaky or crystalline.

Fatty Manna.—This is rarely met with. It is of a reddish brown, soft, viscid, having a strong honey smell and a mawkish taste. It contains many impurities.

Composition.—The principal ingredients in manna are a peculiar sweetish principle called mannite 60, sugar and a bitter purgative matter 5·5, and water 32. Manna softens by the heat of the hand, and melts at 125°. It dissolves in three parts of water and in eight of alcohol.

Effects.—Manna is nutritive and laxative. It operates mildly, but is apt to produce flatulence and griping. From its mildness it was formerly often given to women, especially when in the state of pregnancy. For the same reason and for its sweetish taste it was given to children. But it is now very rarely used alone, and not by any means as frequently in combination with senna, with which it was once the fashion in medicine to unite it.

Dose.—One ounce for an adult, three drachms for a child.

CASSIA FISTULA (*purging cassia*).

The cassia fistula grows in the East Indies, Egypt, Arabia, and Persia,

also in the West Indies and South America. It is a fine tree, thirty or forty feet high. The fruit is a cylindrical pod about an inch in diameter, and from one to two feet long. The outside is hard and dark brown; the inside divided into numerous cells, each of which contains one smooth, oval, shining seed, imbedded in a soft pulp. This pulp is the part used in medicine.

Effects.—To produce any effect it must be taken pretty freely, as a small quantity being digested fails altogether of any cathartic effect. An ounce will act as a mild laxative. Its coloring matter often blackens the stools. It is very little used.

TAMARINDI FRUCTUS (*tamarinds*).

This is the fruit of a large and very beautiful tree growing in India, Arabia, and Egypt, and also in the West Indies. The fruit is a pod the size of that of the garden bean. It has a brittle, woody husk, containing one or more seeds imbedded in a pulp. It is imported free from husk and is preserved in raw sugar.

Effects.—A very gentle cooling laxative, usually employed to make a pleasant drink in fever. It is very rarely used alone as a laxative.

Tamarind whey, made by boiling an ounce of tamarinds in a pint of milk and straining, is a pleasant cooling drink, also slightly laxative.

RHUBARB.

This is the product of different species of *Rheum*, of which there are a number. This plant grows in Tartary and China, and is cultivated in different parts of Europe. Which of the species yield the rhubarb of commerce is not precisely known. The species cultivated in England is the *R. palmatum*. In France, *the R. undulatum, compactum, and rhaponticum.*

The mode of preparing it in the East is the following: The root is dug up in the spring and autumn, and after removing the bark it is cut into pieces, through which holes are bored for the purpose of passing cords. By these they are hung up and dried. During this process the root loses much of its weight.

General properties.—Rhubarb comes in solid pieces of considerable size, covered with dust of a yellow color. When this is rubbed off, the surface presents a reddish white tint, of a reticular appearance. When broken, the fracture is rough, presenting a variegated appearance, owing to the intermingling of white, red, and yellow parts. Here and there are found a star-like spot, and numerous streaks and veins of a red color; its odor is

peculiar and aromatic—taste bitter and astringent. When chewed, stains the saliva yellow and feels gritty, owing to the oxalate of lime; yields a powder of a yellow color.

The principal varieties of this article found in the market, are the *Turkey*, *Chinese*, and *European.*

Turkey.—This is the same as the *Russian* rhubarb, and is the best kind. This rhubarb comes from Tartary, and is brought to a place called Kieatcha, a Russian town on the frontiers between Russia and China. Here the article is examined by an agent of the Russian government, and the bad pieces rejected. From thence it is sent to St. Petersburgh, from whence it is exported to different parts of Europe. Formerly it was sent from Tartary to Turkey through Natolia. Hence the name of *Turkey* rhubarb, which it more commonly bears even at present.

Chinese.—Also called *East India* rhubarb. This comes from Canton, and is supposed to be obtained from a species of rheum, growing in China. Although resembling each other in their general properties, the *Russian and Chinese R.* may be readily distinguished. This is important, as the first is much dearer than the second, and frauds are frequently practised in the sale. They differ—

1. In the *shape* of the pieces. The *Russian* has a somewhat angular appearance, as if the bark had been shaved off, taking pieces of the root with it. The *Chinese* is rounder, as if the bark had been merely scraped off.

2. The *perforations* are different. In the *Russian* they are large, sometimes only partly through the pieces. They are evidently made for the purpose of examining the condition of the inner part of the root. In the *Chinese* the holes are small, and pieces of cord frequently found in them. The insides of the perforations, too, are dark colored, and frequently decayed. The holes here appear evidently made simply to pass cords through, and not with a view to examine the root.

3. The *texture and weight* are different. Russian rhubarb is not so compact and heavy as the Chinese—cuts with less facility in consequence of giving way before the knife.

4. *Color.*—Russian rhubarb has a more lively fresh appearance. Powder, bright yellow; Chinese, orange.

5. *Smell* of Russian rhubarb more aromatic—taste, pleasant.

European Rhubarb.—This is different both in appearance and in effect on the system, from the preceding varieties. It is in large pieces—more woody in its texture—scarcely gritty under the teeth—when chewed somewhat mucilaginous, and only slightly colors the saliva—pasty under the pestle, and its powder darker colored. In England, this is said to be extensively used to adulterate the foreign rhubarb.

Purity.—In the state of powder it is hardly possible to judge well of the quality. The only properties by which any opinion can be formed, are

the taste and color. The best plan is to buy it in the root and have it pulverized.

In selecting the root, those pieces should be preferred which "are moderately heavy and compact—of a lively yellowish color—brittle—presenting when broken, a fresh appearance, with reddish yellow veins intermingled with white; odor decidedly aromatic, brittle, and astringent but not mucilaginous taste—gritty—staining saliva yellow—powder bright yellow, or yellow mingled with orange," U. S. Disp. When very light, rhubarb is usually rotten or worm eaten. When very heavy and compact it is of inferior quality.

Although Russian rhubarb is superior to the Chinese, yet the best kinds of this latter are very good and much cheaper. Real Russian rhubarb is very rarely seen here.

Composition.—The principal constituents of rhubarb are:—1. *Rhubarberic acid.* This is the yellow, coloring matter of rhubarb. 2. *Gallic and tannic* acids. These constitute the astringent matter. The red veins are the seat of this astringent matter. 3. *Oxalate of Lime.* This gives the gritty taste to rhubarb. In the different varieties, the proportions of this differ. In European rhubarb there is scarcely any, while in Asiatic rhubarb, Brande found 14 per cent. 4. *Starch.* The proportion of this differs. The English contains a large quantity—14 per cent., while the Asiatic contains very little. Besides these it contains gum, lignin, various salts, and water.

Rhubarb yields all its virtues to alcohol and water.

Effects.—As a cathartic this article is peculiar, differing from every other in the fact of its combining a cathartic and an astringent operation. In small doses, it acts as a tonic to the digestive organs, and proves astringent. In full doses it acts as a cathartic, and leaves behind it an astringent effect. In its general operation it is mild, the only unpleasant effect which it produces is griping. The evacuations which it causes are fœcal rather than watery. It promotes secretion moderately. It appears to act more on the muscular than the mucous coat of the intestines. Although it gripes, it never produces inflammation of the bowels like some of the more active articles. During its use the coloring principle is absorbed and shows itself distinctly in the urine. Pereira says, the milk of nurses using it purges—differs from aloes, in not acting so much on large intestines.

From the peculiarity of its action, it is suitable only in certain conditions of the system. When the bowels are relaxed, and when a purgative and astringent tonic effect is required, it is exceedingly valuable. Hence it is so used in the summer complaints of children.

When free secretion from the intestines are required, it is objectionable, and in general in febrile and inflammatory states of the system, it is improper. As a remedy in habitual costiveness, too, it is objectionable, although in some cases, where costiveness depends on laxity of intestines, it is good.

As a purgative for children whose bowels are apt to be debilitated by acid and flatulence, it is an excellent article.

Dose.—*Forms.* Various. *Powder*, 20 to 30 grs.

Pill. Simple and compound, vide Pharmacopœia.

Mixture.—Generally rubbed up with Mint Water.

Aromatic Syrup.—This is an excellent laxative for children. Dose ʒ i to ʒ iij.

ALOES.

This substance is the inspissated juice of the leaves of different kinds of the aloe tree. The mode of obtaining it is very simple. The leaves are cut near their roots, and then placed with the cut ends downwards. The juice, of a greenish yellow color, readily exudes thus from the leaves, in which it is lodged in large longitudinal vessels. It is then collected and evaporated by exposure to the sun, or by boiling, until it becomes about the consistency of honey, when it is poured into skins or calabashes. This forms the purest kinds of aloes. In some places, the leaves are subjected to pressure, for the purpose of increasing the quantity. In this way the real aloetic juice becomes mixed with the mucilaginous juice of the leaves, and the quality of the article is impaired.

In other places, the leaves are boiled after the juice has exuded, and the decoction evaporated to a suitable consistence. In this way a still inferior kind of aloes is obtained.

The principal varieties of aloes are the following: The *Socotrine*, *pure Hepatic aloes*, *Cape aloes*, and *Barbadoes aloes.*

1. *Socotrine aloes.*—This is obtained from the *Aloe socotrina*, and comes from Socotra, an island near the Straits of Babelmandel. The greater part of it is carried to Egypt, and from thence to Smyrna, from whence it is exported. A good deal of it, however, goes to Bombay, and from thence to Europe.

This comes in pieces of a reddish brown color, sometimes of a garnet red, sometimes of a golden red. The best pieces have a smooth, glassy, conchoidal fracture, edges translucent; very good pieces, however, break with a rough fracture. Its taste is bitter, odor aromatic, and by no means disagreeable, resembling that of myrrh. Heat readily melts it; and under the fingers, it softens like wax. Its *powder* is of a golden yellow color.

2. *Cape Aloes.*—This is the product of the *Aloe spicata.* It comes from the Cape of Good Hope. In mass it is of a deep brown color, with a greenish tinge; in thin laminæ, it is red and transparent. Fracture, glossy and resinous. Has a very strong and disagreeable odor, without any aroma. Powder, greenish yellow.

3. *Barbadoes Aloes.*—Product of *Aloe vulgaris.* Comes from the West Indies in large gourds, weighing from 60 to 100 pounds. Generally known

by the name of Hepatic aloes. Of a dark brown or liver color; its fracture generally dull, not so smooth, nor its edges so sharp or transparent as the two first kinds. Taste bitter and nauseous. Odor strong and nauseous, without any aroma. Powder dull olive yellow.

Besides these there is another kind of aloes—the *Caballine or Horse aloes*, so called from its being used in veterinary practice. This is a very inferior kind, and is said to be prepared by boiling the leaves after the better kind of aloes has been obtained from them. It is opaque and almost black, and has an exceedingly offensive odor. Generally mixed with sand and other impurities.

Composition.—Aloes contains a bitter principle called alorsin, probably a compound of several proximate principles, a resinous matter, a trace of albumen and an acid, by some thought to be gallic.

It yields its virtues to both water and alcohol. It is almost entirely dissolved in boiling water, which, on cooling, deposits the substance called resin.

Effects.—Aloes in small doses is stomachic, improving appetite and assisting digestion. Its action as a purgative is peculiar, and it fulfils certain indications better than any other drug.

1st. It is very slow; eight, twelve, or even twenty-four hours elapse before it operates.

2d. It does not disorder the stomach, but on that organ is rather tonic.

3d. It acts on the liver, increasing its secretions.

4th. It acts especially on the lower intestines, and is very apt to produce irritation in the rectum and pelvic viscera.

5th. It affects mainly the muscular and very little the mucous coats of the intestines, producing large, thick, copious, and bilious stools.

From these peculiarities of its operation, the class of cases to the treatment of which they are specially appropriate, is very obvious. When we desire to unload the bowels without disordering the stomach; when the liver is torpid, and we wish to rouse it to action, without stimulating the mucous membrane; when we desire to remove costiveness, and yet avoid debilitating either the system at large or the intestinal canal in particular, no other remedy will meet our wishes with the certainty of aloes.

Preparations and modes of administration.—Aloes in substance is only given in pill; if the full effect is desired, 10 grs. must be given; to remove the habit of costiveness, a much smaller quantity given in daily repeated doses will answer. For this purpose we have no cathartic superior to the dinner pill, a combination of aloes, extr. wormwood, and gum mastic.

Decoction of aloes is so very unpleasant that though officinal it is not much used.

Tinct. aloes cum myrrha, elixir proprietatis.—This is a most excellent purgative for children; both as a remedy for torpid liver, habitual constipation, or worms, it answers an admirable purpose.

CARBO LIGNI (*vegetable charcoal*).

This is a well known substance, with the sensible qualities of which you are all familiar, and of the chemical history of which it is not necessary I should speak.

It has the property of absorbing different gases, and, though in a degree far inferior to animal charcoal, of destroying the taste and smell of a variety of animal and vegetable substances, especially when they are putrid.

Its uses in medicine are various; but at present it is only to be noticed as a cathartic. It had at one time a very great reputation, especially in obstinate constipation, in obviating which, Dr. Daniel says it will succeed when mercury, &c. &c., fail. Most late authorities deny altogether its powers; and as it is totally insoluble, it is difficult to imagine that it can produce any other than mechanical effects.

Perhaps, as suggested by Dr. Chapman, it may produce an antiseptic effect ou the excretions present in the bowels, and thus render them less irritating, while in its mechanical effect the mass is evacuated. It is now little used as a cathartic. It may be given in almost any quantity—a teaspoonful is the usual dose.

JALAP.

For a long time the plant supposed to yield this substance was the *Convolvulus jalapa.* This is now ascertained not to be the case. The plant which yields it is the *Ipomœa jalapa*, called also the *Ipomœa purga.* This is a climbing plant, growing native in Mexico. The jalap of medicine is the *root*, and derives its name from *Jalapa*, a place about which the plant grows abundantly, and from which it is sent to Vera Cruz and thence to other countries. It was first brought to Europe about A.D. 1610.

The *root* is tuberose, and as found in the market, the tubers are either entire or cut into slices. They are of various sizes, sometimes as large as a man's fist, but generally much smaller. When *entire*, they are of an oval shape, with pointed extremities and marked with incisions on their surface, evidently made for the purpose of drying. They are solid and heavy, covered with a brown, wrinkled cuticle. When broken they present a surface of a deep yellow grey color, interspersed with deep brown concentric circles. The *slices* vary in size and shape.

Its *powder* is of a pale brownish color, with a peculiar odor and a taste somewhat sweetish and pungent. When swallowed it affects the throat with a sense of acrimony and causes a flow of saliva; when inhaled it causes sneezing and coughing.

Purity.—The best pieces of jalap root are those which are the hardest, most difficult to pulverize, and which have the greatest number of concen-

tric circles in the interior. The inferior or spurious pieces are light—whitish internally, and spongy or friable. Jalap is apt to be *worm-eaten.* These animals, however, only devour the amylaceous and gummy parts, but leave the resinous part untouched. The effect of this is to render it stronger, as the resin is the active part. Hence this should not be used for the powder. For obtaining the resin it is equally good.

Composition.—Jalap yield its virtues partly to alcohol, partly to water, wholly to dilute alcohol.

Effects.—A very active and efficient but safe cathartic. It quickens the peristaltic action and promotes intestinal secretion. Its operation is generally attended with nausea and afterwards griping. The evacuations which it causes are watery. The general effect of it on the intestines is debilitating, and it does not heat or excite the system like some other cathartics.

The uses of it, therefore, are obvious. In all cases where it is desirable to evacuate thoroughly the intestines, when torpid and loaded with mucus, and especially the large ones, and to make a decided impression on them in the way of intestinal secretion, jalap may be used with advantage. It is speedy in its operation.

When the bowels are in a state of irritation, or when hemorrhoids, &c., are present it is objectionable.

To obtain the full effect of it, it should be of good quality; otherwise, apt to be uncertain and variable in its action.

Forms. *Powder.*—Dose 10 to 30 grs. Generally given in combination with calomel.

Pul. Jal. Comp.—Pulvis purgans; *Jalap* 1 part. *Bi-tart. Pot.* 2 parts.

Dose.—40 to 60 grs. Much used in dropsy.

Tinct.—Seldom used alone; sometimes added to purgative draughts in doses of ʒi to ʒij.

Extract.—In this you have a combination of *resin* and *gummy extractive.* The resin, however, is the only active part. The advantage of the gummy part, however, is that it makes it operate more mildly. If water be not used you only get the resin.

Of the *resin* the dose is from 3 to 6 grs.; of the *extract* 10 to 20 grs. The extract is a dark brown substance, not used by itself, but enters into the manufacture of pills.

PODOPHYLLUM PELTATUM—RADIX (*May apple—the root*).

This is a plant common in almost every part of the United States. The leaves are poisonous. The root, the part used in medicine, is smooth, dark brown color, white within, from three to six feet long, having an acrid, disagreeable taste. It gives up its active principles to water and alcohol.

Effects.—As a cathartic it resembles jalap, producing the same watery stools, but by some it is said to gripe less though it nauseates more.

Dose and mode of administration identical with those of jalap.

PHYTOLACCA DECANDRIA (*the Poke weed—American nightshade*).

A common plant indigenous to this country, and growing in every part of it from New England to Florida. It is found in open woods and uncultivated fields. It grows to the height of six or eight feet and dividing into numerous spreading branches, with large rich leaves and purple berries. The root, which is perennial, is large, fleshy, and fibrous, dividing into two or three branches. The parts used in medicine are the *root* and *the berries.* The root, however, is the most powerful and is the part generally used. When dried it is of a yellowish brown color, without smell, taste slightly sweetish, but followed by a sense of acrimony. Its virtues are extracted both by water and alcohol.

Effects.—This article acts as an *emetic, cathartic,* and *narcotic.* As an emetic it has been said to resemble ipecac, and by some it has been recommended as a substitute for that article. It differs, however, very much from it. It is very slow in its action, taking at least an hour before it operates, and after it once begins it continues to vomit for three or four hours. At the same time it purges, although the vomiting which it produces is mild, yet sometimes narcotic effects follow, such as vertigo, impaired vision, &c. It is therefore very different from ipecac. In small doses it appears to act as an alterative, promoting the secretion of the liver and acting moderately on the bowels.

Form.—20 to 30 grs. in powder as emetic, 1 to 5 as alterative. As the latter it is used principally in chronic diseases. A saturated tincture of the berries is also used in the country in rheumatism—a teaspoonful three times a day.

As a local application in the form of ointment it is also used in Tinea capitis and other cutaneous affections with great advantage. ℥i of powdered root or leaves to ℥i of lard.

The proper period for gathering is in the autumn after the leaves have fallen off. To be cut in thin transverse slices, dried, pulverized, and kept in tight bottles.

Dr. Taswell, a country physician, who has used it a good deal, recommends it to me very highly. He says its action on the liver is very like calomel, and that it even salivates. In combination with aloes and gamboge he uses it as a cathartic. The pill is grs. ij aloes, ½ gr. of each of the others; one pill is laxative, four a full dose.

SALINE CATHARTICS.

SULPHAS SODÆ.

This is known by the common name of *Glauber's Salts*, and is so called from Glauber, by whom it was first prepared. It exists in a native state and is also prepared artificially.

Native State and Preparation.—In its native state this salt is found existing frequently in mineral waters, also in sea water. It is sometimes met with in a state of efflorescence on the surface of the ground in the neighborhood of salt lakes. Captain Franklin states that to the north of Carlton House, on the river Skatchawan, lat. 53° 20′, is a small lake, on the shore of which, in the summer time, it effloresces in the form of a white powder to the depth of two or three inches.* According to Captain Hall in his "Journey to South America" the valley of Copiapo, on the coast of Chili, is covered with a layer of this salt several inches thick. It has the appearance of snow on the ground.†

The salt used in medicine is artificially prepared. It is generally obtained during the processes for the manufacture of muriatic acid. The muriatic acid is obtained from the muriate of soda, which is decomposed by the action of sulphuric acid. After the muriatic acid is separated by distillation, a salt remains which is the sulphate of soda with excess of acid. For the purpose of neutralizing this excess of acid, the salt is dissolved in boiling water and to this is added carbonate of lime. The solution is then evaporated, filtered, and crystallized.

Chemical Composition.—Sulphate of soda consists of one equivalent of sulphuric acid, 40; one of soda, 32; and ten of water, 90 = 162. It contains, therefore, more than half its weight of water.

Properties.—This salt, when first prepared, is in white, transparent crystals, and has a cool, bitter, and nauseous taste. When exposed to the air it effloresces, and is converted into an opaque white powder. When subjected to the action of heat it undergoes watery fusion.‡ It is soluble in three parts of cold water and in one part of boiling water. In alcohol it is insoluble.

Physiological Effects.—This is a valuable cathartic and was formerly much more extensively used than it is at present. It is speedy in its operation and acts by promoting free secretions from the internal surface of the intestinal canal, thus causing copious thin serous evacuations.

* Franklin's Journey to the Polar Sea, p. 506.

† Vol. ii. p. 22. Quoted by Dr. Thomson in the London Dispensatory, p. 565.

‡ Mr. Brande says, "it sometimes liquifies in very warm climates and therefore should be previously dried if intended for equatorial consumption, it being only necessary to recollect that half an ounce of the *dried* sulphate is equivalent to about an ounce of *crystals*." Manual of Pharmacy, p. 164.

It operates mildly, producing only a slight disagreeable sensation in the stomach and afterwards transient uneasiness in the bowels. The great objection to it is its exceedingly nauseous taste and its consequent offensiveness to most stomachs. It is on this account, principally, that it has been so generally superseded by the sulphate of magnesia.

Dose and Mode of Administration.—To an adult the dose is about one ounce, dissolved in water. To disguise the taste, a portion of lemon juice or cream of tartar may be added. It is important to recollect that when in a state of efflorescence half the quantity will produce the same effect. Like some other salines (especially nitre) sulphate of soda has a very notable effect on the plasma of the blood, diminishing the quantity of fibrine. This is probably not a universal nor a very constant effect of the salines, still it is interesting as throwing light on the modus curandi of these articles in inflammation.

SULPHAS MAGNESIÆ.

This is called the *bitter purging salt.* It is also known by the name of *Epsom salts*, from its having been first artificially obtained from the evaporation of the water of the celebrated Epsom Springs, in England. This was done by Dr. Grew, in 1675.

Native State and Preparation.—This salt is found native in its pure state, either in the forms of crystal or in the state of efflorescence. In the mercury mines of Idria, it is found crystallized. In Andalusia in Spain large tracts of land are covered with an efflorescence of it after floods. It also exists in certain caverns in some of the Western States in this country.

What is used in medicine is prepared artificially and chiefly from the liquor which remains after the crystallization of muriate of soda (common salt) from sea water, which holds sulphate of magnesia in solution along with muriate of magnesia. By boiling and evaporation, crystals of sulphate of magnesia are deposited. The salt thus found is not pure, inasmuch as it contains muriate of magnesia, in consequence of which it deliquesces.

For the purpose of obtaining it in a state of greater purity another method of preparing it was adopted by Dr. Henry of Manchester, from magnesian limestone. According to this process the magnesian limestone, consisting of the carbonates of magnesia and lime, was first calcined for the purpose of driving off the carbonic acid gas. The magnesia and lime were then treated with muriatic acid with the view of taking up the lime. The muriate of lime is thus held in solution while the magnesia is precipitated. The two are then separated, and the magnesia is converted into the sulphate by the addition of sulphuric acid.* Prepared in this way, it contains no muriate of magnesia, and, therefore, does not deliquesce.

* Thomson, vol. ii. p. 314.

At Bathmore it is prepared from the silicious hydrate of magnesia, *marmolite.*

Chemical Composition.—This salt consists of one equivalent of sulphuric acid, 40, one of magnesia, 20, and seven of water, 63 = 123.

Properties.—Sulphate of magnesia usually forms in small needle-like crystals—white and transparent. Its taste is bitter and saline. When exposed to the atmosphere, if pure, it slowly effloresces. When it deliquesces, it is owing to the presence of muriate of magnesia. It dissolves in its own weight of water at 60°, and in three fourths of its weight of boiling water. In alcohol, it is insoluble.

Effects.—Like those of sulphate of soda, though it is less apt to offend the stomach or gripe, and operates rather less promptly. It is the best and far the commonest used of the saline purgatives. The dose is from one to two ounces. The best way of disguising its taste is to add lemon juice to the solution.

TARTRAS POTASSÆ ET SODÆ.

This is commonly called *Rochelle salts,* from its having been first prepared and introduced into practice by an apothecary of Rochelle in France, by the name of Seignette. From him, too, it was called the *salt of Seignette.* The discovery of this salt was made in 1672, but its composition was kept a secret.

From this circumstance, no doubt, it gained great celebrity, and from its being supposed useful in almost all complaints, it was called *Sal polychrest* or the salt of many virtues. In 1731, the chemical constitution of it was ascertained by Bouldac and M. Geoffroy.

Mode of Preparation.—This salt is prepared by simply adding bitartrate of potassa finely pulverized to a solution of carbonate of soda. Here the excess of acid in the bitartrate of potash combines with the soda, forming the tartrate of soda, while the carbonic acid escapes with effervescence. In this way a double tartrate of potash and soda is formed.

Chemical Composition.—This salt consists of two equivalents of tartaric acid, 132; one of potassa, 48; one of soda, 32; and ten of water, 90 = 302.

Properties.—This salt is in large, white, regular crystals. Its taste is bitter and saline; when exposed to the air it slightly effloresces. It is soluble in five parts of water at 60°, and in much less boiling water.

Physiological Effects.—This salt is similar in its operation as a purgative to those already noticed. It is less unpleasant than most of the saline cathartics, but it is also less active.

Dose.—From one ounce to an ounce and a half is a dose for an adult.

TARTRAS POTASSÆ.

Tartaric acid combines with potash in two proportions, the one forming an acidulous salt, *bi-tartrate of potash*—the other a neutral salt, *tartrate of potash.*

This is commonly called *soluble tartar,* from its great solubility in water when compared with the bi-tartrate, which is very insoluble.

Mode of Preparation.—Soluble tartar is prepared by taking a solution of carbonate of potash, and adding to it bi-tartrate of potash reduced to a fine powder, and boiling. Here the excess of acid with bi-tartrate is neutralized by the potash, while the carbonic acid escapes with effervescence. By a slow evaporation regular crystals form.

Chemical Composition.—This salt consists of one equivalent of tartaric acid, 66; and one of potassa, 48 = 114.

Properties.—If properly prepared, soluble tartar forms in white crystals. As generally found in the shops, however, it is in a granular form. This is owing to the mode in which it is prepared. To obtain regular crystals the evaporation ought to be slow and nearly spontaneous. As commonly made, however, on a large scale, the evaporation is hastened by frequent stirring, which interferes with the crystallization. It has a cool, bitterish taste. In the form of crystal it is soluble in its own weight of cold water; in the granular form it requires four times its weight. In hot water its solubility is increased. In alcohol it is also soluble. When exposed to the atmosphere it deliquesces.

Effects.—As a cathartic this salt acts mildly yet efficiently. It causes no griping and possesses the properties of correcting the griping effects of senna and other cathartics. On this account it is frequently employed. It operates quietly with them; and like the other saline cathartics, produces watery evacuations from the bowels.

Dose.—From ʒij to ℥j in any bland fluid. Not much used.

SUPER-TARTRAS POTASSÆ—CALLED ALSO BI-TARTRATE—ACID TARTRATE.

This is called *crystals of tartar* or *cream of tartar,* and is a salt existing in the juice of the grape and is deposited in the form of a crust on the sides of casks of wine, during the slow fermentation which wine undergoes when kept. This goes under the name of *tartar,* and is either red or white according to the wine from which it is deposited. By dissolving this substance in boiling water and filtering, brown crystals are deposited. The coloring matter is then separated by again boiling the crystals, and adding white clay, whites of eggs, or wood-ashes, which attract the coloring matter.

Properties.—Crystals of tartar consists of small, irregular, brittle,

whitish crystals. They are easily reduced to powder and in this state are called *cream of tartar*. Its taste is sharp and very acid, very sparingly soluble in water, requiring 120 parts of cold and sixty parts of boiling water to dissolve it.

Composition.—Crystallized bi-tartrate of potash, carbonate potash, 1 atom, 47; tartrate acid, 2 atoms, 132; water, 1 atom, 9. Total 188.

Effects on the System.—This is a pleasant, cooling laxative. It requires to be taken in doses from ʒiij to ℥j to produce its effect. It is taken in solution sweetened with sugar.

SULPHAS POTASSÆ.

This is the *vitriolated tartar*. It was formerly known by a great variety of names, such as *sal de duobus, arcanum duplicatum, sal polychrest, &c, &c.*

Preparation.—The sulphate of potash is obtained from the salt which remains after the distillation of nitric acid. Nitric acid is procured from the action of sulphuric acid upon nitrate of potash. The nitric acid is liberated and distilled off, while the sulphuric acid unites with the potash and forms a bi-sulphate of potash which is left behind. This salt is dissolved in boiling water, and the excess of acids is neutralized by adding carbonate of potash or lime. By filtration and evaporation the sulphate of potash is obtained in a crystalline form.

Properties.—This salt is in small, white, hard, irregular crystals. It has a bitter and disagreeable taste. When exposed to the air, it undergoes no change. It requires 16 parts of cold water and five parts of boiling water to dissolve it. In alcohol it is insoluble; when heated it decrepitates.

Chemical Composition.—It consists of one equivalent of sulphuric acid, 40; one of potash, 48 = 88. It contains no water of crystallization.

Effects.—From the sparing solubility, this salt acts with less rapidity than the other neutral salts. From its remaining, however, longer in the intestinal canal it is more thorough in its operation as a cathartic. It has in some cases produced most violent and even fatal effects even in moderate doses. The reason of this is not well known.

Dose and Mode of Administration.—The dose to an adult is from one to two drachms. From its great insolubility, however, it is seldom given alone or in solution—generally in combination with other articles, such as rhubarb, aloes, jalap, &c. Given in combination with rhubarb in the proportion of 10 or 15 grains of the former to 5 of the latter. It is an excellent purgative for children of five or six years, in cure of visceral obstruction.

PHOSPHATE OF SODA.

This is the *tasteless purging salt*, and was first introduced into practice as a cathartic, by the late Dr. George Pearson of London.

Mode of Preparation.—It is obtained by first calcining common bones to whiteness. By this process the animal matter of the bones is consumed, while the earthy matter, the phosphate of lime, remains. This is now pulverized and subjected to the action of sulphuric acid, which, combining with a portion of the lime, leaves the rest in the state of *super-phosphate of lime.* For the purpose of separating this from the sulphate of lime, boiling water is added, which holds the super-phosphate of lime in solution. This is decanted and partially evaporated. To this is then added a solution of carbonate of soda. The soda combines with the excess of phosphoric acid, forming *phosphate of soda*, leaving a neutral phosphate of lime, which is insoluble, and is precipitated. By filtration and evaporation, crystals of phosphate of soda are obtained from the solution.

Chemical Composition.—It consists of one equivalent of phosphoric acid, 28; one of soda, 32; and twelve of water, 108; = 168.

Properties.—Phosphate of soda forms in large transparent crystals. It has a cool and purely saline taste, without any bitterness. It resembles in its taste very much common salt. On exposure to the atmosphere it effloresces and falls into an opaque white powder. It is soluble in four times its weight of cold and twice its weight of boiling water.

Effects.—As a cathartic this is mild and efficacious. It has nothing disagreeable in its taste, and produces no nausea or irritation. It is exceedingly valuable, therefore, in all cases of delicate health, and where the stomach is weak and irritable. From the ease with which it can be disguised, it is also an excellent article for children.

Dose.—From ℥ i to ℥ ij. The best mode of giving it is in broth or gruel.

SENNA.

This is the product of different species of the cassia, a shrub growing in various parts of the world. The principal species are the following:—*Cassia acutifolia*—*Cassia obovata*—*Cassia ethiopica*, and the *Cassia marylandica.*

1. *Cassia acutifolia.*—This grows in the valley of Bicharie, near Syene, upon the confines of Egypt and Nubia. Two or three feet in height—so called from the shape of the leaf, which is *acute* or *lance shaped.*

2. *Cassia obovata.*—This grows in upper Egypt, Syria, and Senegal. It has also been cultivated for many years in different parts of Europe, and especially in Italy. From one to two feet high; leaf *obtuse, obovate.*

3. *Cassia ethiopica.*—Grows to the south of Tripoli—about eighteen inches high—leaf *oval, lanceolate.*

4. *Cassia elongata.*—Grows in the southern parts of Arabia, and in India. So called from the length of the leaf.

The leaves furnished by the foregoing species of cassia, although they differ in some respects, have certain characteristics in common, by which they may be distinguished from other leaves with which they may happen to be mixed.

The characteristics of the genuine senna leaf are the following:

1. The two sides of the leaf are unequal in size and shape.

2. The veins or nerves of the under surface of the leaf are very conspicuous.

They differ from each other: 1. In their shape; some are acute, some obovate, some elongated. 2. In their length; the acute are one half to one inch in length, the obovate are about the same, while the elongated are from one inch to twenty lines.

As found in commerce, we have three different kinds of foreign senna; the *Alexandria*, the *Tripoli*, and the *Indian Senna.*

1. *Alexandria Senna.*—So called from the port from which it is exported. This is made up of different kinds of leaves, and the manner in which it is prepared for exportation is the following. The senna plant of Upper Egypt yields two crops, the abundance of which depends upon the periodical rains. The first is in September, the second in March. When the flowers begin to fall, the plants are cut and exposed on the rocks to dry in the sun. The leaves are then picked, packed in bales, and sent to a place called Boulac, the port of Cairo. This senna consists chiefly of the acute-leaved. To the same place are sent quantities of the obovate leaf, from other parts of Egypt and from Syria. These are then mixed together in the proportion of five parts of the acute-leaf, three parts of the obovate, and two parts of the leaf of another plant, the *Cynanchum oleafolium*, commonly called *argel.* Thus mixed, they are repacked in bales, and sent down to Alexandria, from whence they are exported. The Alexandria senna, then, is made up of three different sorts of leaves—those of the *Cassia acutifolia*, of the *Cassia obovata*, and the *argel leaves.* The argel leaves are distinguished from the true senna leaf by their being longer, by the absence of lateral nerves, and by their sides being regular, and terminating at the same point on the petiole.

2. *Tripoli Senna.*—So called from the place from which it is exported. It is the product of the *Cassia ethiopica.* Resembles very much in its appearance the leaflets of the Cassia acutifolia. They are somewhat smaller, however, not so acute, and the lateral nerves not so distinct. Generally this is unmixed with any obovate leaflets.

3. *Indian Senna.*—There are two kinds of senna which go under this name, viz. the *Mecca senna* and the *Tinnevelly senna.* Both are the pro-

ducts of the *Cassia elongata*, and distinguished by the length of the leaf. The first is the product of Arabia, and finds its way to England through India. The second is cultivated at Tinnevelly, in the southern part of India.

Physical Properties.—As already stated, senna differs in size and shape. Has a yellowish green color; odor resembling that of tea, with a viscid and somewhat nauseous taste.

Good senna should have a bright fresh color, and an agreeable smell, somewhat like that of green tea. It should not be largely mixed with stalks, seed pods, &c., nor much broken, nor very dusty.

Chemical Composition.—According to the most recent analysis, it contains: 1. *Cathartine.* This is supposed to be the active purgative principle—a yellowish red uncrystallizable substance, with a peculiar odor and bitter, nauseous taste; three grs. caused nausea, griping, and purging, &c. In addition, contains, 2d. *Yellow coloring matter*; 3d. *Volatile oil*; 4th. *Fixed oil*; 5th. *Albumen*; 6th. *Mucus*; 7th. *Malate and tartrate of lime*; 8th. *Acetate of potash*; 9th. *Mineral salts*; 10th. *Lignin*, &c.

The virtues of senna are extracted both by water and alcohol.

Effects.—A valuable, certain, and safe cathartic. It makes a decided impression on the intestinal canal, causing in consequence a considerable derivation of blood to this part. Frequently it produces a good deal of heat, flatulence, and griping. In proportion to the local degree of irritation which it causes, the pulse becomes more or less excited, and thirst is produced. The evacuations produced by it are liquid and yellower than natural, resembling the color given to water by infusing the leaves. From this it has been inferred that it operates principally on the mucous membrane of the small intestines and upon the liver, promoting the secretion of bile.

From the general operation of senna, it may be considered as one of the *milder drastics.* Although a very active article, it is yet a safe one. It is accordingly given very freely to children and to women after delivery, not merely without injury, but with advantage.

A great objection to its use with some is its odor. This to some is so offensive, as of itself to cause purging.

To obviate the griping which it causes, aromatics, such as cardamum or caraway seeds, are added. The best additions, however, are some of the alkaline salts with manna.

From the peculiar operation of senna, its uses are obvious, when the bowels are torpid; and when a decided revulsive operation upon these organs is required, it is an excellent article. Although not so active or irritating as some purgatives, it cannot be used when any irritation or inflammation of the bowels is present. For the same reason, it ought not to be used where hæmorrhoids exist.

The East India senna operates quite as well as the Alexandria.

Mode of Administration.—*Powder*, ʒss. to ʒi. not used—too bulky and disagreeable.

2. *Infusion.*—Senna ℥i, coriander seed ʒi, water one pint, macerated for an hour and strained. This is a form in common use. It should be prepared only when wanted. By keeping and exposing to the air, the extract contained in the senna becomes oxidyzed, and is precipitated. This gripes exceedingly, but does not purge. Most commonly sulphate of magnesia is added to this infusion, with manna. This is called the *black draught*—ʒij repeated every two hours. For a child, senna ʒi, manna ℥ss, water ℥iii; tablespoonful every hour.

3. *Tincture.* Comp.—*Elixir salutis*, senna, caraway seed, cardamom, raisins, proof spirit—a stimulating, cordial cathartic—good when the tone of the digestive organs is impaired, and when there is flatulency—good for intemperate, ʒij to ℥i.

4. *Syrup.*—Dose for children, ʒi to ʒii.

5. *Confection.* Lenitive electuary.—This was formerly a good deal used, but has now gone out of fashion.

CASSIA MARYLANDICA.

Commonly known by the name of American Senna. It is a tall showy plant, growing in most of the States south and west of New York, commonly found in moist situations and the borders of streams—flowers from June to the latter part of August. Flowers, bright yellow. The leaves—the officinal part—are smooth, green above, yellowish green below, from one to two inches long, a quarter of an inch broad, having the odor and smell of foreign senna.

Effects.—An active cathartic very like senna; by some thought less active, though this is denied by others who deem it fully equal in strength to the foreign. The difference probably depends on the different modes of collecting and preserving the leaves.

SCAMMONY.

This substance is obtained from the root of the *Convolvulus scammonia*, a plant growing native in Syria. It consists of a number of slender twining stems fifteen or twenty feet long, extending along the ground, or climbing upon neighboring plants. The *root* is perennial, from three to four feet in length, and from ten to twelve inches in circumference.

The mode of obtaining the scammony is the following:—About the beginning of June the ground is removed from the upper part of the root, the top of which is then cut off in an oblique direction, about two inches

below the origin of the stems. Small vessels or shells are fixed under the root in such way as to receive the *milky juice* which oozes out from the cut surface. Each root furnishes only a few drachms, and the whole of this flows out in about twelve hours. The juice thus collected from different roots is put together, and on standing concretes into solid masses. This is the *pure scammony.* Generally, however, while it is yet in the soft state, it is adulterated by mixing it with the expressed juice of the stalks and leaves, and not unfrequently with flour, ashes, fine sand, and chalk.

As found in the market, scammony is of different qualities, depending upon the degree of adulteration. Formerly the best kind was called *Aleppo scammony*, and the inferior kind *Smyrna scammony.* These names are not used at present, however, I believe. The best kind is now called *Virgin scammony*, and the inferior kinds, *seconds* and *thirds.*

Virgin scammony comes in amorphous pieces of a dark color, sometimes covered with a white powder. As this powder effervesces with hydrochloric acid, it is chalk in which the pieces have been rolled. They are friable and break readily under the pressure of the fingers, presenting a black and brilliant fracture. When rubbed with the finger, moistened with water or saliva, it forms a whitish liquid on its surface. Its smell is cheesy; and its taste, at first slight, becomes afterwards acrid.

The *inferior* kinds of scammony come in large flat masses or cakes. The better sort, however, sometimes amorphous. Not so friable and its fracture generally dull.

Tests of the goodness of Scammony.—1. Its fracturing readily under the pressure of the fingers.

2. Its dark and brilliant fracture.

3. Its specific gravity. The best kind is the lightest. According to Pereira, the Virgin scammony has a sp. gr. of 1.210. The inferior kinds are heavier.

4. If hydrochloric acid be added to a fractured surface, no effervescence takes place. If effervescence does take place it shows the adulteration with *chalk.*

5. The decoction of its powder filtered and cooled is not rendered blue by the addition of tincture of iodine. If it is, it shows the adulteration with *flour.*

6. Sulphuric ether separates 80 per cent. of resin dried at 280.

7. When rubbed, with the finger moistened with water or saliva, forms a milky liquid.

Composition.—The principal ingredients are *resin* and *gum*, varying in their proportions in different specimens. According to the analysis of Vogel and Bouillon Lagrange, *Aleppo scammony* contained, in 100 parts, 60 resin, 3 gum, 2 extractive, 35 vegetable and earthy remains. While

Smyrna scammony contained 29 resin, 8 gum, 5 extractive, 58 vegetable and earthy remains.

Being a gum resin, it is soluble partly in water and partly in alcohol. Diluted alcohol dissolves all but the impurities.

Effects.—Scammony is one of the drastic hydragogue cathartics. It resembles very much, in its general action, jalap, being, however, more active and more liable to produce nausea. Generally operates speedily, and frequently gripes and causes a good deal of local irritation. Its action varies with the state of the bowels. If lined with mucus, it passes through without producing much effect. When this is not the case, acts with much more power. Sometimes brings away a good deal of mucus and bile along with serum.

In combination its action is greatly modified—rendered much milder.

Scammony is useful in all cases when it is desirable to make a strong impression on the bowels. In torpid states of these organs, it is accordingly a valuable article. Whenever active irritation or inflammation of the bowels is present it is objectionable.

Although an active cathartic, it is generally a safe one, and is accordingly used in the affections of children, where the bowels are torpid and where an active cathartic is necessary. In cases of worms, it is commonly used in combination with calomel.

Mode of Administration.—Powder.—This is given intimately triturated with gum arabic, starch, or sugar. This is supposed to render its action milder. Of this the dose must vary according to the purity of the article. Of *Virgin scammony*, six to ten grains for an adult; of the *common*, ten to twenty grains. For a child, from three to five grains.

A good way of giving it is in the form of an emulsion with milk.

Resin.—This operates like the scammony itself, only in smaller doses—eight to ten grains. Has no advantage over good scammony.

GAMBOGE.

This is the product of the *Stalagmatis cambogioides*, a tree growing in Siam, and in the island of Ceylon. In Siam, it is procured by breaking the young shoots and leaves of the tree and collecting in cocoa nut shells the juice which exudes in drops of a yellow milky appearance. It is then transferred into large earthen jars, where it remains until it is dried to a proper consistence, when it is formed into rolls and covered with leaves. Sometimes the juice is collected in the hollow joints of bamboo, and as it solidifies, leaves a hollow in the centre, forming the gamboge into the shape of a pipe.

As found in commerce, it is in three different forms; in *solid rolls*, in *cylindrical pipes*, and in *irregular masses.* The two first are known by

the name of *pipe gamboge*, the last *cake gamboge*. The poorest pieces of all the varieties are called *coarse gamboge*. Pipe is the best. Good gamboge is an opaque substance of an orange color, bitter, and breaking with a conchoidal fracture, of a uniform color; when taken into the mouth it has no taste at first, but afterwards leaves an acrid sensation in the throat. It yields a powder of a bright yellow color. The *inferior kinds* of gamboge are harder, the fracture is earthy and of a brownish color; color of the fractured surface not so uniform, has dark spots in it from the presence of foreign bodies, generally adulterated with starch, fragments of wood, &c.

Tests of its Purity.—1. The peculiar fracture. 2. If a decoction of its powder be tested with tinct. of iodine, rendered *green*, if *starch* be present.

Composition.—The best analysis of this article is that of Prof. Christison. According to him the purest kind consists of 1. *Resin*. This he calls *gambogin* or *gambogic acid*. This is a brittle substance in thin layers of a deep orange color. It is insoluble in water, but soluble in alcohol and more so in ether. In doses of 5 grs. this acid produced free watery discharges, without griping or uneasiness. He infers from this that the activity of gamboge does not depend entirely on this acid, for if it did 5 grs. of it would be equal to 7 of gamboge, which is not the case. 2. *Soluble gum* or *arabin*, analogous to gum arabic. 3. *Woody fibre*, only a trace. 4. *Moisture*.

The inferior kinds contain large proportions of *woody fibre* and *starch*.

The proportions of these ingredients in the different kinds of the article are found to vary very much.

Gamboge is dissolved partly by alcohol and partly by water. It is also dissolved by the successive action of ether and water.

Effects.—Gamboge is a powerfully hydragogue cathartic. Its effects vary with the dose. It promotes intestinal and urinary secretion, and produces liquid evacuations from the bowels. In larger doses it causes nausea, vomiting, griping, and copious watery stools. Sometimes it causes great irritation of the mucous membrane of the intestines. In over doses it acts as an acrid poison and causes death.

The peculiarities of this article are 1. That it is very apt to affect the stomach. This is owing to its easy solubility in the juices of that organ. 2. It operates very rapidly.

As a cathartic, it may be used in all those cases where it is desirable to make a decided impression on the intestines and to produce copious watery evacuations. In cases where the bowels are irritable, or where there is general debility, it is dangerous. This is one of the articles which entered into the composition of Morrison's pills which did so much mischief.

Doses, &c.—From the general propensity which gamboge has to affect the stomach from its ready solubility, the best form of giving it is that of *pill*, and in *small* doses, frequently repeated. It is accordingly given in this way—a pill of 1, 2, or 3 grs. every three or four hours till it operates;

a full dose is from 3 to 6 grs. Gamboge is generally given in combination to quicken the action of other articles.

Pil. Camb. Comp. in which the gamboge is combined with aloes, carb. potass. and soap is a good cathartic in dropsy and congestion of the brain.

COLOCYNTH.

The plant yielding this is the *Cucumis colocynthis, the Bitter Cucumber;* growing native in Japan, Turkey, Nubia, the Cape of Good Hope, and the Grecian islands. In Spain it is cultivated. It is an annual plant resembling very much the common garden cucumber. The stems are trailing and beset with rough hairs. The *fruit* which it yields is a *round berry*, about the size of a common orange, with a smooth skin of a yellow color. Inside it has a white spongy pulp filled with seeds. It is *this pulp* which is used in medicine. The mode of preparing it is simply to peel the fruit when yellow and ripe, and dry it in stoves. In this state it is exported.

As found in the shops, it is in the state of the dried round fruit, generally peeled. The pulp is light and spongy, of a white color, and filled with seeds. It is destitute of smell, but has an exceedingly bitter and nauseous taste. The only part of the fruit possessing active properties is the pulp. The seeds are said to be destitute of them, and are, therefore, separated from the pulp.

The powder is of a pale yellow color.

Composition.—Colocynth contains a peculiar bitter principle, called *colocyntin.* This is a resinous substance of a yellowish color, extracted by the action of alcohol. It is brittle and exceedingly bitter. In alcohol it is very soluble; in water, sparingly so, imparting to that fluid, however, an intense bitter. This substance possesses the active properties of the colocynth in a concentrated form. In doses of one or two grains, it is said to be a good substitute for the croton oil.

Besides this colocynth contains a resinous matter, insoluble in ether—fixed oil—extractive matter—gum, and various salts.

The virtues of colocynth are extracted by ether, alcohol, and water.

Effects.—In small doses, colocynth acts as a safe and valuable cathartic, increasing the peristaltic action of the intestines, and at the same time promoting intestinal secretion. In full doses, it acts as a drastic and hydragogue, causing, besides watery evacuations, severe irritation, griping, and sometimes bloody stools. It appears to pass rapidly over the small intestines, and to exert its principal effect on the large ones. If given in too large doses, it has proved fatal, producing the effects of a narcotico-acrid poison. Analogous in its general operation to gamboge, except that gamboge operates more on the small intestines. Resembles aloes in acting on

the large intestines, but differs from it in producing more secretion and being less tonic.

Dose.—2 to 8 grains in powder, mixed with gum or starch. Seldom, however, given in this way. Generally in form of extract, and in combination.

Ext. Colocynthidis Comp.—Is a very popular and a very active cathartic, much used in obstinate constipation and in dropsy.

ELATERIUM.

The plant which yields this article is the *Momordica elaterium*. It was known to and used by Hippocrates. The common name is the *wild* or *squirting cucumber*. It is an annual, growing native in the south of Europe, especially in Sicily, Italy, and the south of France, in uncultivated and stony situations. In England, it is cultivated exclusively for medicinal purposes. In that climate, however, it does not survive the winter. The root of the plant is thick and fleshy, sending out trailing stems spreading in different directions, resembling those of the common cucumber. Its *fruit*, also, resembles that of the common cucumber, being only much smaller. It is about two inches long and one inch thick, of a greenish grey color, and covered with prickles. When perfectly ripe, the fruit separates from the stalk, and scatters its seeds and juice to a considerable distance. It is from this peculiarity that it derives the name of the *squirting cucumber*. The elaterium of medicine is obtained from the *fruit*.

The quality of the elaterium depends in a great measure upon the manner in which it is prepared. From a series of extracts, made by Dr. Clutterbuck of London, it appears that the active principle of the cucumber resides only in *the juice which surrounds the seeds*. The fruit itself, the seeds, as well as the stalks, leaves, &c., contain little or none of it. It is from this, therefore, that the pure elaterium is obtained.

The *best kind* of *English elaterium* consists of thin, slightly curled flakes, marked with the impression of the linen on which it has been dried; of a pale, greyish green color, becoming yellow by exposure; very light and friable; taste acrid and bitter, with very little odor. It is readily reduced to powder. This is called *E. album.* The inferior kinds (*E. nigrum*) are hard, breaking with difficulty; more curled, gummy, and dark colored.

Purity.—Elaterium differs greatly in its shape owing to two causes. The mode of preparation—actual adulteration with other substances.

1. *From the Mode of Preparation.*—That obtained according to Dr. Clutterbuck's method is the purest and strongest. That obtained by pressure is not so pure or strong, and these differ according to the degree of pressure. Then again, if the juice from which the elaterium is deposited

be suffered to stand too long before it is separated, a mucilaginous matter subsides which greatly impairs its strength. This renders the elaterium dark and gummy.

The adulterations are with *chalk and lime*, generally in the Maltese kind.

Tests.—1. It should be friable. 2. Of a pale green greyish color. 3. Thrown on water it floats. 4. Does not effervesce on the addition of diluted hydrochloric acid. It it does, it shows the presence of chalk. If the acid solution be neutralized by ammonia, gives no precipitate on the addition of oxalate of ammonia. If chalk be present throws down a copious precipitate (oxalate of lime). 5. Touched with the tincture of iodine gives no evidence of presence of starch. If this be present turns it blue.

Chemical Composition.—According to analysis of Mr. Hennell of London, elaterium contains in 100 parts, 40 parts of a peculiar crystallizable substance which he called *elaterin*, 17 parts of green resin, starch 6 parts, woody fibre 27 parts, saline matters 6 parts.

Effects.—Elaterium is among the most active of the *hydragogue* cathartics. It makes a powerful impression on the mucous lining of the intestines, causing free secretion and copious watery evacuations. If the dose be somewhat large it acts with great violence, causing sickness and vomiting, together with irritation, and in some cases actual inflammation of the bowels. From the local irritation which it produces, general febrile excitement is apt to occur during its action; the pulse becomes excited, the tongue and skin dry, together with great thirst.

As this, then, is an article which operates so powerfully, its use must be limited to those cases in which the bowels are torpid, and where it is desirable to excite a powerfully revulsive action in the intestines and to cause free intestinal secretion.

On the other hand, whenever any local irritation of the intestines exists it ought not to be used. In delicate habits, too, and in young subjects it ought not to be used.

It is important to know in relation to this article that it is uncertain and variable in its operation. Large doses at one time produce little effect, while small ones are sometimes followed by violent effects. This is owing to two causes. 1. The difference in the strength of the article. 2. The difference in the state of the intestines.

Mode of Administration.—The best form is that of *pill*, made with extract of gentian. The *dose* must vary with the strength; of the *best kind* one sixteenth to one eighth gr. is sufficient; of the ordinary kind one half a grain; of the black kind 2 or 3 grs. are sometimes used. The dose to be repeated every two or three hours until the desired effect is produced.

Elaterin is crystalline, very bitter, no smell, neither acid nor alkaline; insoluble in water and soluble in hot alcohol. One sixteenth of a grain operates like a dose of elaterium.

CROTON OIL.

The plant which yields this is the *Croton tiglium*, a tree growing ten or fifteen feet high; a native of China, Cochin China, Ceylon, the Molucca islands, and the greater part of the East Indies. The *fruit* is a capsule about the size of a filbert, with three cells divided by membranous partitions, each containing one seed. It is from the *seeds* that the *oil* is obtained. They are about the size of the castor oil seeds; viewed laterally they have an oblong shape, but from either extremity their shape is four-sided, having two of the sides convex and the other two somewhat flattened. The *shell* of the seed is black, but is covered with a soft yellowish brown epidermis. The *kernel* is of a yellowish brown color. The seeds have no smell; taste at first mild but soon becomes hot and burning, which continues for some time.

The seeds are imported from the East Indies in cases, and from the friction which they undergo during their transportation the epidermis is generally rubbed off. On their first introduction into Europe they were known by the name of *Molucca grains.*

The croton seeds are actively cathartic, producing the effects of a hydragogue. This is the form in which this article is frequently used in the East Indies. The seeds are first well dried by a fire and the shells carefully removed. This is supposed to correct the acrimony of the seeds. They are then pulverized and made up into pills with honey, each pill containing 2½ grs. of the powder. Two of these pills are an ordinary dose for an adult. Mr. Marshall says this dose is about equal to ℨss of jalap or to grs. vi of calomel. The stools are invariably watery and copious. It operates without nausea and griping, except in occasional instances.—(Ainslie, vol. i. p. 104.)

In Europe and in this country the only preparation that is used is the *oil.*

Croton Oil.—This is obtained by first roasting the seeds and then separating the shells; after this subjecting them to strong pressure. In this way 50 per cent. of their weight of oil may be procured.

The oil is of a reddish yellow color, with a faint odor and of an unctuous thickness, like castor oil. Its taste is hot and acrid, leaving an uneasy feeling in the mouth and throat, which continues for some hours.

Chemical Composition.—Dr. Nimmo, who early investigated the subject, states the composition thus:—acrid purgative matter 45, bland fixed oil 55=100.

This acrid matter was supposed to be of a resinous nature, but the subsequent analysis of Brande established the existence of a peculiar principle, *crotonin*, and an acid, *crotonic.*

Croton oil is soluble in ether, the fixed and volatile oils. In absolute

alcohol cold it is insoluble but soluble in hot, from which it is again deposited on cooling.

Effects.—Croton oil is an active hydragogue cathartic and operates with great rapidity. It determines powerfully to the intestines and produces copious watery evacuations. In moderate doses, although it operates actively, it does not produce much nausea or griping. If the dose be somewhat large, it occasions considerable intestinal as well as general irritation. As a cathartic it is suited to those cases in which there is great torpor of the bowels and where an active revulsion upon those organs is desirable. In children and feeble habits, or where inflammation of the intestines is present, it ought not to be used. What is peculiar to this article is that the simple application of it to the tongue, without swallowing, will cause purging. One or two drops applied in this way will operate and may be resorted to in cases where the patient has lost the power of deglutition, as in apoplexy, tetanus, &c. Rubbing it on the bowels, too, will produce the same effect, although not with the same degree of certainty. It ought to be recollected that this oil is variable in its action.

Mode of Administration.—The ordinary mode is that of *pill*, made up with crumbs of bread, each pill containing a drop of the oil. To an adult, one or two of these is an average. A better way is to take a pill every hour or two until the desired effect is produced.

MERCURIAL PURGATIVES.

Calomel.—Of the history and properties of this most important article I shall speak at large under the head of sialagogues; all that is now necessary to dwell upon is its action as a cathartic. In this respect, it is peculiar and produces effects widely different from those of other medicines of the class. The peculiar effects of calomel depend not upon its mere cathartic power, but on its action upon the liver and the mucous membrane of the bowels. The chief of these peculiarities are :—

1st. Its action on the mucous membrane is peculiar and often very salutary—increasing the secretion and seeming to enable the membrane to throw off any viscid mucus with which it may be coated.

2d. Its influence on the liver is marked, and its cathartic operation has been by some attributed to its increasing the flow of bile.

3d. It is slow, often taking from 8 to 12 hours to produce any effect—the motions are few and commonly large.

4th. The operation of calomel is rarely attended by much griping, but often by nausea and prostration even to the extent of fainting.

5th. The action of calomel is permanent, and it does not leave behind it that tendency to constipation which follows the use of many cathartics.

6th. There is yet another peculiarity in the operation of calomel to

which I wish to call your especial attention, and that is that when given in large doses, it does not produce any corresponding irritation. On the contrary, it seems to act as a sedative to the intestinal canal. On this principle, scruple doses of calomel have been given in dysentery and other intestinal disorders. The purgative effect is not increased and the irritation is lessened by thus doubling the dose. Its depressing effect on the whole system is very markedly increased. From a scruple of calomel, the alvine evacuations will be neither more numerous nor more copious than from six or eight grains, but the prostration will be far greater. Cases are recorded where by mistake very large doses of calomel have been taken, ℥i or more. The purgation was generally very moderate.

Of late years immense doses of calomel have been given in Asiatic cholera and some other diseases.

[Pereira gives some cases from the records of a London cholera hospital, in which calomel was given in frightful doses. Three drachms on the entrance of the patient into the hospital, and one drachm every hour till in some cases 20, 25, and 30 drachms were given. In none of these cases did violent irritation or profuse salivation occur. Seventeen out of eighteen cases recovered. The patient who died took 53 drachms in 42 hours, without sensible effects. The best that can be said of this practice is, that it did not kill.—*Ed.*]

For the purpose of testing the effects of calomel upon the stomach and intestines, Mr. Annesley instituted some experiments upon dogs, which are very curious and interesting. He took three healthy dogs and gave to one ʒi of calomel; to a second, ʒij; to a third, ʒiij. After this they were tied up in a room.

"The dog which took ʒi did not appear to feel any kind of sickness, till six or seven hours afterwards, when he vomited a little. He was lively the whole time, and ate his food well; had been purged two or three times; dejections of a black grey color."

"The dog which took ʒij was likewise lively, and ate his food well; vomited two or three times, and was purged more than the other; he passed tape worms, and the dejections were black."

"The dog who took ʒiij was heavy, and apparently uncomfortable the whole day; did not vomit at all; he was purged and passed a very long tape worm; dejections also black."

Twenty-four hours after they had taken the calomel, the dogs were all killed; and five minutes after they were dead, they were examined, and the vascularity of the stomach was found to be in the inverse ratio of the calomel which they had taken, i. e. in the dog who had taken ʒiij, the vascularity was the least, and so on. For the purpose of comparing this with the condition of the stomach of a dog which had taken no calomel at all, an examination of another dog was made, and here the stomach was *more vascular* than in any of the others. From these experiments, Mr.

Annesley draws the conclusion, "that the natural and healthy state of the stomach and intestinal canal is high vascularity, and that the operation of calomel in large doses is directly the reverse of inflammatory."

Therapeutical Effects of Calomel.—Upon the use of calomel as a purgative, in different diseases, so much was said in my general remarks on purgatives, that I will not now go into the subject at all in detail. Suffice it to say more by way of recapitulation than anything else, that in fevers and inflammations, whatever be the type of the former, or the location of the latter, calomel may, with the precautions and restrictions which were detailed when I spoke of purgatives generally, be used with excellent effect. In jaundice, too, it will often produce the happiest results. For obstinate constipation depending on torpor of the bowels it may be also given with advantage.

PILULA HYDRARGYRI (*blue pill*).

This is a mercurial purgative, not so much used as a cathartic, yet capable, when given in adequate doses, of producing free purging, with most of the advantages which attend the operation of calomel.

Of its pharmaceutic history I shall speak under the head of sialogogues. Its dose as a purgative should be from 15 to 20 grs. The practice of giving five grs. of blue pill at bedtime, and a senna draught in the morning, so highly recommended by the late Dr. Abernethy, has lost some of its favor with the profession; yet for a very large class of cases of constipation it is of great value. Blue pill is an excellent purgative for children; five grs. given at night will commonly operate in the morning; and its influence, if given early in the febrile and inflammatory affections of children, is usually most salutary.

COMBINATIONS OF CATHARTICS.

In what has been said of individual cathartics I have confined myself to a notice of the effects which they produce when given separately. And I have done this with the twofold design of showing that all cathartics do not act precisely alike, and to enable you to understand the principles upon which they are combined in our ordinary prescriptions. On this account I have omitted saying anything in relation to these combinations until the present time. After stating briefly the object to be attained by uniting different cathartics in one prescription, I shall analyse the whole of them with the view of illustrating the principles upon which these combinations should be made.

1. The first object to be attained by *combining cathartic medicines is to*

increase their activity. This may be done either by increasing the rapidity with which they operate or by increasing the actual effect produced.

2. The second object is to *make them act more mildly.* A number of valuable cathartics you now know act with such *intensity* and produce effects so unpleasant, in the way of nausea and griping, when given alone, that their use in this way is exceedingly objectionable. By judicious combination this may, to a very great extent, be obviated.

3. The third object is to obtain in *one combination the effect of different cathartics.* As I have already stated, these articles act in various ways—some increase the peristaltic motion—others cause copious secretions from the inner surface of the intestines—while others again act by promoting the biliary secretions. Now by uniting different cathartics all the effects may be produced by one prescription.

These are the principal objects to be gained by combining these articles, illustrations of which you will find in the notice which I shall now take of the different substances belonging to this class.

1. *Of Laxatives.*—Generally speaking these do not require any combinations. Being used for their mildness and simplicity, they do not require any addition to them to modify their operation. In fact as a general rule the best form in which they can be given is alone. They are sometimes, however, combined, and then their effects are very much modified.

Those which are best administered alone are *castor oil*, *magnesia*, *sulphur*, and *cream of tartar*. *Manna* and *cassia*, from the quantity in which they are obliged to be taken, are apt to sit heavy on the stomach and frequently to cause griping and uneasiness. On this account they are not so commonly given alone. Generally they are combined with the more active purgatives, of which I shall speak hereafter. *Sulphur* and *cream of tartar* are frequently combined, and the compound is more active than either separately. *Sulphur* and *magnesia* combined frequently answer an excellent purpose. You have a gentle laxative suited to acid states of the digestive organs. As magnesia only operates as a cathartic when it meets with an acid in the alimentary canal, its activity is promoted by following it with cream of tartar.

2. *Of Purgatives.*—It is in these especially that the advantages of combination are shown.

Senna.—This substance, as already stated, when given alone is apt to produce a great deal of griping. By combining it with manna this is corrected. It is rendered milder in its operation though not less effectual—at the same time all the unpleasant effects of the manna when given alone are also obviated by the senna. By combining senna with some of the neutral salts its griping effects are also corrected, while the compound is more active in clearing out the bowels than either separately. A very useful and good combination consists of *senna*, *manna*, and *epsom salts.* It acts thoroughly and yet pleasantly.

Rhubarb.—This is a cathartic which is given very conveniently and advantageously alone. It is mild in its operation and sits easily on the stomach. It is frequently, however, combined with advantage. With *magnesia* it forms a very valuable compound in all cases where you wish an antacid effect together with a tonic purgative. This is peculiarly useful in cases of enfeebled and deranged stomach from over feeding or over drinking. The most common combination of it, however, is with calomel. Here you combine the peculiar operation of both—that of the rhubarb on the stomach and intestines, and that of calomel on the liver. With aloes, which is laxative and tonic, it forms a useful tonic. It combines the united operation of rhubarb on stomach and small intestines and aloes on large.

Jalap.—This is a very active cathartic and operates well when given alone. Generally, however, it is combined. With super-tartrate of potass, with equal parts of cream of tartar, it makes the *pulvis purgans* so commonly used. By this union the jalap is rendered milder and the whole effect is increased. United with *calomel* the double effect is obtained upon the liver and upon the intestinal canal.

Scammony.—This is an active article and liable to gripe when given alone. This is corrected by combination with other cathartics, and what is singular those of a very active character.

By a union of *Aloes, Scammony, and Colocynth,* in the form of the compound colocynth pill, you get a preparation more permanent in its operation than aloes alone, and yet without the irritation and unpleasant effects either of scammony or colocynth.

Gamboge.—This is a very active griping cathartic, operating with uncommon celerity, and usually when given alone, commencing its action in the stomach and causing nausea and vomiting. On these accounts it cannot well be given alone. By combination, however, it is rendered a manageable and valuable cathartic. By combining it in pill with aloes, which is very slow in its operation, and does not affect the stomach, you get a purgative in which the effect of gamboge on the stomach and bowels is corrected, and yet more active than aloes alone.

Generally speaking, gamboge is used in only small quantities, say gr. j., to increase the activity of other articles when you want to produce a strong *hydragogue* effect.

Elaterium.—This is generally given alone.

Croton Oil.—Generally speaking, this article has been used in its uncombined state, and principally with the view of getting the very active hydragogue effects which it produces.

It has, accordingly, in this way been chiefly used. By combination, however, it may be made much more available as a general cathartic. In combination with *Calomel* or *Blue pill,* in the dose of half a drop to six or eight grains of the latter, its general efficacy has been increased, while the

nausea and griping which it is apt to produce have been obviated. With the compound pill of rhubarb, too, it forms a good combination.

Neutral Salts.—Very commonly these are given by themselves, and this is a very good way when the object is merely to wash out the existing contents of the intestines. Their activity is considerably increased by mixing them together. This curious fact is illustrated in some mineral waters (such as Cheltenham Salts). Another instance is in the sulphate of magnesia, which acts with great effect if the muriate of magnesia be present.

Of the combination of the neutral salts with senna and manna I have already spoken.

Calomel.—This article enters into a great number of combinations, which it is unnecessary to enumerate. In all cases where the object is to promote the secretion from the liver, it forms a useful addition to cathartics. It may be given either alone, and then followed in five or six hours by some quick cathartic to carry it through the bowels, such as neutral salts; or it may be given in combination with other articles, such as powder of *jalap, rhubarb, butternut, may apple, croton oil, &c., &c.* In this way you get the combined operation of calomel on the liver, and the other articles on the intestines.

ENEMATA (*clysters*).

From the great susceptibility of the mucous surface of the lower bowels, it is evident that medicinal substances may be applied to it to produce impressions not merely on the intestine itself, but on the system at large. Hence enemata are used for a great variety of purposes. At present I shall only speak of them as agents intended to evacuate the bowels, either by their own powers, or by promoting the operation of cathartics. Used for this purpose, they are of very great value.

Cathartic enemata operate in two different ways; first, by the mere stimulus of distension causing contraction of the gut; second, by an irritation of the mucous membrane of the rectum, they stimulate the muscular coat, and in that way provoke contraction. This impression is frequently conveyed to the upper portion of the large intestines. Enemata are capable of fulfilling three indications:

1. They evacuate the lower portion of the alimentary canal.
2. They assist and expedite the operation of other cathartics.
3. By the irritation on the intestine they act as revulsives, and thus relieve distant parts. They are made more or less stimulating according as they are intended for one or other of these purposes.

To evacuate the lower bowels we use either those which act by mere distension, or those which are only moderately stimulating.

1. Warm water, warm gruel, molasses, and water. These operate by distension only. The quantity to be given is from a pint to a quart. Pereira objects very strongly to the large enemata recommended by late authors, insisting that "it is rarely proper to use more than a pint." That "large quantities destroy the tonicity of the gut," &c. I think experience has shown the entire safety and manifest utility of large enemata. Injections may be made slightly more stimulating by adding to the warm water, salt, oil, or soap. These are of course more efficient and better calculated to aid the operation of a cathartic.

If a still more active enema is desired, decoctions or infusions of the various purgatives may be used, as dec. aloes, inf. sennæ, solutions of the purgative salts, &c.

If a strong revulsive action is required, dec. colocynth, or the spirits of turpentine made into emulsion with gum arabic or eggs, may be tried.

The instrument used, and the manner of using it, are by no means indifferent matters. The best instrument is the valve syringe, but the ordinary enema syringe, if good, will answer very well with care. The tube or bag to which a pipe is attached, and from which, the pipe being introduced into the rectum, the fluid is allowed to run by its own gravity, is very good, and has the great advantage that it is impossible to do any harm with it. The common pipe and bladder are unhandy, but safe. The fluid should be injected very gradually, and the greatest care taken to avoid injuring the parts with the pipe.

ANTHELMINTICS.

Anthelmintics are those medicinal substances which possess the power of destroying and expelling worms from the human system.

I shall first give you a brief account of some of the different kinds of worms which are found infesting the human body. They may be divided into two general classes, viz. those which infest the intestinal canal, and those which are found in other parts of the body. I shall treat of the first of these only.

Of those Worms which infest the Intestinal Canal.—These are four in number: the *tape-worm*, the *round-worm*, the *ascarides* or *maw-worm*, and the *thread-worm*.

1. The *Tape-worm*, *Tænia.*—This is a very long worm, made up of flat articulations, united by means of a border or edge varying in breadth and thickness. It is of a whitish color, and varies in length usually from twenty to thirty feet. It generally occupies the small intestines. The head is turned upwards and firmly insinuated in the mucous membrane, while the body extends floating down the intestinal canal. There are two species which have been found in the human subject.

(*a.*) *Tænia lata*, or as it is now called *Bothriocephalus latus*—the broad tape worm. This species has been found chiefly in the inhabitants of Poland, Switzerland, Russia, and some parts of France. In other parts of Europe it is not found. In this species the articulations are broader than they are long, and the whole worm is broader and thicker than the other species—the tænia solium. The breadth varies from one eighth to one quarter or more of an inch. Its general length is from fifteen to twenty feet. Its color is dusky and not so white as the tænia solium.

(*b.*) *Tænia Solium*—the solitary worm—so called from its being supposed that never more than a single one was found in the intestinal canal at the same time. Satisfactory observations have, however, proved this to be incorrect. This species is found in the inhabitants of Europe generally, with the exception of those nations in whom the tænia lata is met with, in whom it is not often found, though occasionally the two species of worm are found in the same individual at the same time. Among the Egyptians it is also common. It is not so broad or so thick as the other species. Its length however is greater, averaging from twenty-five to thirty feet. Its color is commonly a pale white. This species of tænia

is never passed entire, and it possesses the curious property of parting with a number of joints and reproducing others to supply their place. This worm is *Hermaphrodite*, having a double sexual apparatus in each joint.

2. *Ascaris Lumbricoides.* The *long round worm.* This animal is about the thickness of a common quill and from six to ten fingers' breadth long. When first passed it has a transparent appearance, but it soon acquires an opaque yellow tinge. The general shape of the body is cylindrical, but tapering towards the extremities. It is found both in children and adults; in the former, however, it is most common. Its natural abode is in the small intestines, more especially the jejunum and ilium. Occasionally it passes into the stomach and makes its way out by the mouth. Unlike the tænia it exists in great numbers—fifty, a hundred, and even a greater quantity having been discharged, in a few days, from the same person. Occasionally it is found with other worms.

3. *Ascaris Vermicularis,* also known by the name of *Oxyuris vermicularis*—the maw or thread worm. The common name by which they are known is *ascarides.* This is a small worm with an obtuse head, and varying in length from one line to five and six lines. The part of the intestines in which this worm is generally found is the *rectum,* sometimes also in the colon, and occasionally in the cœcum. In children and young subjects they are more common than in adults. In females they are sometimes found in the vagina, from whence they have been known to pass up into the urinary organs. In some very rare cases, they have been detected in the stomach and œsophagus. This worm is never found alone, but always in conglobate masses. According to Bura, the ascarides live longer in the human body than any other worm.

4. *Tricocephalus Dispar*—thread worm—the long thread worm, or capillary headed worm. This is a slender worm from one and a quarter to two inches in length and in breadth not more than about half a line. Its color is usually white. This worm is not of a uniform size throughout its whole length. The extremity where the head is situated, is very slender and resembling a thread, and from this derives its name. For about two thirds of its length it continues of this size. The remaining one third towards the tail is much larger.

Evidences of the Existence of Worms.—It is by no means easy to decide in all cases whether worms are actually present. This arises mainly from two causes. In the first place, they most commonly occur in very young subjects, who, of course, can give no accurate account of their symptoms or sensations; and in the second place, the sympathetic irritations occasioned by worms in the intestines, are so diffused over the whole system, so remote frequently from the intestines, and so varied in their character, that it is not always easy to trace them up to their original source.

The symptoms may be divided into two classes, viz. *primary and secondary.*

1. *Primary Symptoms.*—By these I mean the immediate symptoms of local irritation in the intestinal canal. The first of these is *pain* in the abdomen. As may naturally be inferred, from the moving nature of the irritating cause, these pains are not fixed in any particular spot, but wandering over the whole abdomen. They differ, too, in intensity, varying from a mere sense of uneasiness to pains of a more sharp and pricking character. Whenever the stomach and intestines are empty, these pains are aggravated, and on taking food they are usually relieved. In addition to this, the abdomen becomes tumid and tender.

The second symptom is derangement of the functions of the stomach and bowels. This exhibits itself in nausea, eructations, and sometimes vomiting. The appetite is variable—at one time entirely gone, and at another voracious. The bowels are irregular—sometimes costive, sometimes relaxed. Not unfrequently tenesmus is present. Such are the primary and local effects of worms, viz. *irritation in the intestinal canal* and a *consequent derangement of the function of digestion.*

2. *Secondary Symptoms.*—These are various, and show themselves in almost every part of the system.

The *countenance* is generally changed in its appearance. Usually it is of a pale or leaden color, with a red spot on the cheek. The eye becomes dull and frequently fixed; the pupil is dilated, and the under eyelids become tumid and have a bluish streak upon them.

The *nose* is tumid, and itches incessantly. Children are constantly picking their noses.

The *mouth* is full of saliva; the upper lip swollen; the tongue foul and the breath offensive.

The brain and nervous system are also greatly affected. There is headache, especially after taking food—singing in the ears. Sleep is disturbed, and vertigo. Delirium and fainting have all been known to occur. Amaurosis, deafness, apoplexy, and epilepsy have resulted from the presence of worms.

The foregoing is a *general account* of the symptoms indicating the presence of worms. You are not to expect to meet the whole of them in any particular case.

After all, however, the only certain sign is the actual evacuation of worms from the intestinal canal.

Symptoms produced by the different species of worms.—1. ASCARIDES.—As these reside chiefly in the rectum, they cause an excessive irritation about the anus, sometimes extending to the neck of the bladder.

2. TÆNIA.—As may naturally be supposed, the sensation occasioned by this worm is peculiar. Occasionally pricking or biting is felt; most com-

monly, however, it is that of something alive and moving. The abdomen swells at intervals, and then subsides, as it were, by undulation. From time to time, also, a sense of coldness pervades the abdominal viscera; the appetite is voracious, while the more the person eats, the thinner he becomes. The complexion is livid, the eye is dilated; confusion of the head and vertigo. There is sickness at stomach, and sometimes vomiting, with general weakness in all the limbs, and frequent trembling of the whole body.

3. LUMBRICOIDES.—The sensation caused by these animals is much more severe generally than that of the tænia. This arises from the greater number of these generally present, and from their insinuating their sharp points into the mucous lining of the intestines. About the umbilicus, accordingly, severe colicky pains are frequently felt, together with rumbling of the abdomen.

Origin of Worms.—The advocates for spontaneous generation have made the existence and multiplication of intestinal worms and other parasites the great foundation of their theory. Their whole argument amounts, when stripped of its verbiage, to this. We do not well see how a worm can have got into the intestines of a man, still less of a fœtus in utero (where they have been found), or into the liver or the eye; and therefore we will insist that he did not, but has been generated in the spot wherever we find him. This is an argument not from our knowledge, but from our ignorance, and is entirely unphilosophical. Besides which, I have another objection to it in its irreligious character; all life emanates from the Almighty. I need not tell you after this, that I do not believe at all in the spontaneous origin of these animals. However they may originally get into the human body, they are propagated in the ordinary way, though only under certain circumstances of the human body are their germs developed.

Circumstances favoring the development of worms.—These are various, and in a practical point of view are worthy of investigation. A knowledge of them is the only thing which can lead to a correct and philosophical use of the various remedies proposed for their extermination.

1. *A peculiar condition of the intestinal canal.*—The precise condition of the intestines favorable to the development of worms is that in which large accumulations of mucous and other secretions have taken place and are found lining the inner surface.

2. *Age.*—It is a well known fact that children are more liable to worms than adults, and the reason is that there is a greater tendency in them to mucous and crude accumulations in the intestines. There are only two species of worms that children are liable to, viz. ascarides and lumbrici.

3. *Sex.*—As a general rule females are more liable than males.

4. *Diet.*—It is a fact well ascertained that certain kinds of diet are more favorable to the production of worms than others. This must necessarily be the case. The too frequent use of *crude* and *raw vegetables* and fruits

has this effect. The excessive use of *sugar*, *milk*, *butter* and *cheese*, and abstinence from *animal food* have the same tendency.

In a still more striking manner does the abstinence from the use of *salt* produce this effect.

5. *Climate.*—Independently of mode of living, the climate seems to exercise a certain influence in developing worms. They are especially common in India and the western coast of Africa. I have already stated that the tænia lata is only found in the natives of the north of Europe. Tænia solium is very common in Switzerland.

5. *Disease.*—In almost all fevers worms are frequently discharged. Now in many cases of this kind practitioners have been in the habit of ascribing the fever to the presence of these animals. This has been carried too far. Although there can be no question that the irritation of these animals is capable of producing febrile excitement in the system, yet in a great majority of these cases their presence is a mere coincidence, and so far from having been the primary cause of the fever, it is merely the condition of the system and of the intestinal canal occasioned by the fever which has favored their development. For

1. The presence of worms in those cases is not suspected as a general rule until after the fever has been of some continuance.

2. Specific febrile diseases, such as measles, small pox, &c., are attended frequently with the same phenomena.

In debilitating diseases they are very common. Dr. Isaac Wood of this city says that when the cancrum oris prevailed endemically at the Alms House, the intestines of such children as died of it were found "*stuffed full of worms.*"

PRACTICAL RULES TO BE OBSERVED IN THE USE OF ANTHELMENTICS.

These are few and simple, and directly deducible from what has already been stated.

1. In the first place, as worms are always associated with certain conditions of the system, and more particularly of the intestinal canal, you are carefully to analyse these. It is only by so doing that you will be enabled to make a proper selection of the articles appropriate to any particular case.

2. In the second place, as in almost all cases the intestinal canal is in a deranged state, a general rule is to begin with those articles which shall correct this condition of it. Of course the first remedies are active cathartics, and especially those that possess the power of separating mucus from the inner surface of the intestines. The best article suited to this is *calomel*. This may be followed by such articles as act powerfully in unloading

the large intestines, such as aloes, senna, and the like. By these means alone you frequently not merely get rid of the worms but you correct that condition of the intestines which favors their propagation. In cases where this condition of the intestines is accompanied with great laxity and debility tonics are essential, and it is here that *iron* proves so valuable.

3. In the third place, if after the use of these remedies the worms still remain, recourse may be had to those articles which act more specially upon these animals.

4. After the worms are expelled endeavor to fortify the constitution against their return by the use of such means as the nature of the case may render appropriate.

5. In cases of fever supposed to be owing to worms, do not be led astray by importunities of friends to treat it exclusively for these animals.

INDIVIDUAL ANTHELMINTICS.

Classification.—The best and most useful classification of these remedies is to be founded upon the manner in which they operate, and as far as their modus operandi is known, the following is proposed:—

I. Those which act entirely upon the intestinal canal, and thus expel worms. These may be subdivided into two sections, viz.:—

(*a.*) Those which produce evacuations from the intestinal canal. Examples:—*Calomel* and *cathartics generally.*

(*b.*) Those which give tone to the intestinal canal, and thus correct that condition of it so favorable to the development and classification of worms. Examples:—*Tonics*, as iron.

II. Those which act principally on the worms themselves.

(*a.*) Those which appear to act mechanically upon them by irritating the surface of their bodies. *Tin—Cowhage.*

(*b.*) Those which produce some deleterious effect on the worms themselves.

Male Fern,	Artemisia santonica,
Jerusalem Oak,	Chenopodium.

III. Those which act both by a specific operation on the worms themselves, and at the same time on the intestines. These are, of course, the most efficient anthelmintics.

(*a.*) Those which act on the worms, and at the same time prove purgative.

Turpentine,	Pomegranate,
Cabbage Tree,	Pride of China,
Pink Root,	Fœtid Hellebore.

(*b.*) Those which act on the worms themselves, and at the same time give tone to the intestinal canal.

Salt,	Camphor,	Arsenic.

1.—ANTHELMINTICS WHICH ACT BY PRODUCING EVACUATIONS FROM THE INTESTINES.

1. Calomel.—Calomel is certainly among the very best anthelmintics that we possess. It acts, probably, simply by clearing away more effectually than any other medicine, the mucus and other viscid materials generally found lining the intestinal canal in cases of worms, and in which these animals are always found imbedded. It should be given in such quantities, and so often repeated, as to produce its full effect upon the whole secretory apparatus of the intestinal canal, and this object should be accomplished with as much rapidity as possible. The best plan, therefore, is to give it in large doses, with the view of making a decided impression at once upon the intestinal canal, and then following up its use by some active cathartic, for the purpose of carrying off quickly the matters which may have been separated by the action of the calomel. In this way the worm is first removed from its bed of mucus, and then hurried out before it has had time to make any new attachments. It should never be carried to the extent of producing salivation. This can do no good as a mere anthelmintic, and may do much injury to the constitution.

Mode of Administration.—To adults, from ten to twenty grains, and to children, from three to five grains, may be given at night on going to bed; to be followed early in the morning by some active and quick purge, such as castor oil, salts and senna, &c. In many cases a single dose will in this way prove effectual. If it should not, however, it may be repeated again after an interval of two or three nights.

2. Other Cathartics.—All cathartics, to a certain extent, have the power of expelling worms. Bitter, nauseous, and drastic purgatives have been chiefly resorted to for this purpose. Among these, senna, aloes, gamboge, jalap, &c., are the best. For children, a very good article is the tincture of aloes and myrrh, taken in doses of a teaspoonful, mixed with sugar and water.

2.—ANTHELMINTICS WHICH ACT BY GIVING TONE TO THE INTESTINAL CANAL.

Iron.—By many it has been supposed that the efficiency of this metal as an anthelmintic depends upon the mechanical irritation of the worm. The probability is, that it acts by the powerfully tonic impression which it makes upon the mucous and muscular tissues of the intestines. Whether this be the proper explanation or not it is very certain that the preparations of iron are excellent anthelmintics. Of these the *filings of iron* and the *carbonate* are those commonly used. These may be taken in doses of

from 5 to 10 grs. two or three times a day. Dr. Rush prescribed from 5 to 30 grs. every morning to children between one and ten years old. The best plan is to unite it in some cases with rhubarb in equal parts.

Sulphate of Iron.—This is recommended by Rosenstein as the best of the preparations of iron. Possessing more astringency than the others it may have some influence in checking the profuse secretion of mucus, and thus diminishing the disposition in the system to favor the generation of worms.

Other Tonics.—In many cases of worms vegetable tonics may be used with very great advantage. They are not in themselves to be considered as at all destructive to worms, but they produce their effects indirectly by the tone which they give to the intestinal canal in particular and to the constitution at large. Their use of course is to be regulated by the actual condition of the patient, and combined with the specific anthelmintic remedies.

II.—ANTHELMINTICS WHICH ACT ON THE WORMS THEMSELVES.

Cold Water.—From the fact that the tænia when plunged into hot water moves with great vivacity, and on the contrary when put into cold water becomes almost asphyxiated, Rosenstein suggested the plan of destroying and expelling them from the intestines by drinking a large quantity of cold water after taking a purgative. The cold water he supposed would deprive them of the power of fixing themselves in the folds of the intestines, while the purgative in that state would bring them through the intestines. Several tænia were actually expelled in this way. To give it the greatest possible chance of success the water should be taken as cold as possible and repeated frequently. The addition of common salt might be advantageous in two ways, by the specific effect of the salt upon the tænia, which is known to be detrimental, and by the cooling effects of it upon the water.

(*a.*) *Those which act mechanically upon the worms.* 1. *Cowhage, Mucuna pruriens.*—This plant was long considered the *Dolichos pruriens.* It is a perennial plant growing native in the East and West Indies. The fruit is a pod about four or five inches long, containing from three to five oval seeds and thickly covered with short stiff brown hairs. These hairs are the part used in medicine. If incautiously handled they produce intolerable itching and sometimes even inflammation of the fingers. As an anthelmintic this article has enjoyed much celebrity especially in the West Indies, where it has been extensively used. It is principally in expelling the lumbrici that it has been found efficacious. If successful at all against the tænia it requires to be given in much larger doses. With

regard to the manner in which the cowhage operates there is every reason for believing that it is entirely by the mechanical irritation caused by the hairs or setæ upon the worm in the same way as when applied to the surface of the body. If such be the way in which the cowhage operates it may be asked why it does not produce similar effects on the inner surface of the stomach and intestinal canal. This it is difficult to answer. The only explanation at all rational is that the mucus which naturally lines this surface affords a sufficient protection against its irritating effects. At any rate the fact is certain that very large quantities of this article have been taken without any unpleasant consequences ensuing.

Mode of Administration.—The pods are dipped in syrup and this being scraped off removes the hairs with it. When it is as thick as honey it is fit for use. Of this a child may take a teaspoonful twice a day on an empty stomach. It is more likely to prove effectual if a gentle emetic and a free purge be administered a short time before it is given.

STANNUM (*Tin*).—This metal is found in great abundance in Cornwall in England, in Gallicia in Spain, in Bohemia, and in Sumatra. It is also said to have been found in Chili.

Tin has a very slight and somewhat disagreeable taste, and emits a peculiar odor when rubbed. The only form in which it is used in medicine is that of the *powder* or *filings.*

It is against the tænia that this remedy has been chiefly used, and it has proved very successful in the hands of more than one experimentalist. In its general operation on the system, it is a mild and safe medicine, producing no uneasiness of the stomach or disturbance of the bowels. Upon the worms it does not exert any destructive property. It expels without destroying them. The most commonly received opinion is, that it acts mechanically "by getting in between them and the inner coat of the stomach and intestines so as to make them quit their hold, that purgatives may easily carry them away with the fæces." This is Dr. Alston's explanation, and seems as rational as any.

Mode of Administration.—The only form in which tin is used, is that of *filings* or *limatura stanni.* As used and recommended by Alston, the quantity given in a case was ℥ij. The plan was first to purge the patient with senna and manna. On the next day, on an empty stomach, one ounce of the powder mixed in ℥iv of treacle, was administered. On the following day ℥ss more and the same on the third day. The day after he was to be purged again. In this way he found it very successful against both tænia and lumbrici. The usual dose is ʒj to ʒij.

(6.) THOSE WHICH ACT BY SOME DELETERIOUS EFFECT UPON WORMS.

Polypodum Filix Mas or Aspidium.—This is the *male fern*, a common perennial plant growing in Europe. The *root* consists of a great number of matted fibres, forming a sort of head of a blackish color. When dried it is without smell. Its taste is at first sweetish, then slightly bitter and somewhat astringent. When chewed it is mucilaginous. The part used in medicine is the internal portion of the root. The powder which it yields is of a reddish color. If kept for any length of time the virtues of the fern are lost.

The fern as an anthelmintic appears to operate exclusively by its effects on the worm itself. The worm is always dead. On the living system its effects are exceedingly slight, and it exerts a deleterious influence upon the worm without causing any particular movement in the stomach or intestines.

Ordinary mode of administration is to give from ʒj to ʒij in electuary, morning and evening, for two or three days.

Chenopodium Anthelminticum (*Wormseed* or *Jerusalem Oak*)—an indigenous plant, two to five feet high, grows in almost every part of the United States. The *seeds*, the part used, are small, greenish yellow; abound in volatile oil; bitterish, aromatic, pungent taste, with a peculiar smell.

Dose.—ʒij. to ℈ij. bruised, and mixed with molasses for a child, three or four years old; given night and morning for three days, and followed by a cathartic.

Oil of Wormseed.—4 to 8 drops, morning and evening for three days, followed by a cathartic. This article is not now much used, though it was formerly very popular.

THOSE WHICH ACT BY A SPECIFIC OPERATION ON THE WORM AND AT THE SAME TIME PROVE CATHARTIC.

Oil of Turpentine.—This very valuable article is prepared from the concrete juice consisting of resin and oil, which is yielded by the different species of the pine tree. The juice exudes either spontaneously from the tree or from incisions made into it. By distilling this with water in a common still, the oil will be found swimming on the surface of the water, from which it is easily separated.

It is a limpid colorless fluid, of a warm sharp taste, and with a strong and penetrating odor. When swallowed, turpentine produces a sensation of warmth in the stomach, at first increasing the quickness and force of the

pulse, but afterwards diminishing it, and if the dose be large, some degree of nausea is excited with slight vertigo, and usually, though not always, a copious discharge from the bowels. But if the dose be small, it acts chiefly on the kidneys. As an anthelmintic its effects are striking and unequivocal. Besides proving actively cathartic, the turpentine is exceedingly deleterious to the worm itself. In all the cases in which it has been used it has destroyed the worm before it was expelled.

Mode of Administration.—As the object in the use of turpentine is simply to obtain its action on the intestinal canal and its contents, it should be given in as large doses as possible. In this way the full effect of it upon the worm is obtained, and it passes off quickly as a cathartic, without producing any unpleasant effects upon the urinary organs. The dose in which it is to be taken, and in which it operates best for an adult, is from ℥j to ℥ij., taken either alone or in peppermint. Dr. Brande says, "in these doses the oil is best given with a little aromatic water only, or it may be blended with honey or mucilage. It usually nauseates and excites eructations from the stomach, an effect to a great degree prevented by a little brandy. In some cases, however, it has been given in much larger doses, and without the least disadvantage. Three ounces, for instance, have thus been taken. In one case six or seven ounces were taken by a female for tænia. It destroyed the worm, but produced a severe inflammation of the rectum, which, however, was soon relieved by opium, and injections of flaxseed. The proper time for taking the turpentine is in the morning, and on an empty stomach. In this way, it will generally pass through the bowels in an hour and a half. In one instance it operated in so short a time as fifteen minutes, bringing away with it portions of a tænia, and in another an entire tænia was discharged in twenty minutes after it was swallowed. A child of ten years old may take ʒj with safety, and an infant from ʒss to ʒj; here the best vehicle is milk.

Against the lumbrici the turpentine has also been given with success, destroying them in the same way as it does the tænia. As an injection also against the ascarides, it is one of the best remedies we possess.

Pomegranate.—This is the *Punica granatorum*, a native tree of Barbary, and the south of Europe, Arabia, and Persia. In India and Ceylon, it is now much cultivated. In the Indian Archipelago, it is said to be found only in its cultivated state. From Europe it was introduced into the West Indies, where it produces a larger and a better flavored fruit than it does in its own native climates. It grows to the height frequently of eighteen or twenty feet. It has a pulpy fruit about the size of an orange. The part which has been commonly used as a medicine, is the *bark of the root.* Recently, however, the *bark of the stem* has been found equally efficacious. Generally speaking, the worm is expelled in from three to five hours after the remedy is commenced.

Mode of Administration. Decoction.—This is the common way in which it has been given. Made by boiling ℥ij. of the bark in one and a half pints of water down to three fourths of a pint. Of this, when cold, a wine-glassful is to be given every half hour or hour, until four or five doses have been taken.

Spigelia Marylandica (*Pink root*).—This plant derives its name from the celebrated anatomist, *Spigelius*, after whom the genus was named by Linnæus. It is a native of the United States, but only of those south of Virginia. North of Virginia it does not grow wild. It is cultivated, however, and grows luxuriantly. In England it was first cultivated in 1694. It is a herbaceous plant, growing from six to twenty inches high. The root is perennial, consisting of a number of slender fibres, forming a large bunch. When first taken from the ground the fibres are of a yellow color, and become black on being dried. This is the part used in medicine.

This article has an insipid and somewhat nauseous taste. A large proportion of mucilage, but no resin. Its proper menstruum, therefore, is water.

Effects on the System.—In its operation on the system, pink root produces a double effect. In *the first place*, it proves *cathartic* to the bowels, more or less powerfully so according to the condition of the system. In the *second place*, it produces a peculiar effect on the nervous system, resembling that of a narcotic. In some cases this has been carried so far as to be followed by dimness of vision, dilatation of the pupil, spasms, and convulsions. The mind, too, has been known to be affected by it. All these symptoms, however, gradually go off, as a general rule, without leaving any serious injury behind them. From this combination of properties it is not difficult to conceive how this article proves so efficacious as an anthelmintic—acting primarily as a kind of narcotic upon the worm, and secondarily, upon the intestines as a laxative, and thus aiding the expulsion of the animal.

It should be recollected in using this article, that the fresh root is much more potent than when it has been kept for a time. This fact was noticed by Dr. Gardner, and has been confirmed by subsequent trials. Due allowance for this should, therefore, be made in its administration.

Mode of Administration. Infusion.—This is the best form of giving it, and is prepared by putting half an ounce of the root to a pint of boiling water. Of this, from half an ounce to an ounce may be given to a child, and half a pint morning and evening to an adult.

Melia Azedareck. *The pride of India* or *pride of China.*—A tree of 30 or 40 feet; native of Syria, Persia, and North of India, and cultivated at the South and West of this country for ornamental purposes; at the South it is planted in cities and towns. It does not flourish north

of Virginia. The part used is the *bark of the root*, and the recent bark is preferable. It is emetic and cathartic, if given in considerable quantities proves narcotic like the spigelia.

Decoction.—Four ounces of fresh bark boiled with a quart of water to a pint. Of this, half an ounce night and morning to a child for three or four days, and then cathartic.

THOSE WHICH ACT ON THE BOWELS, AND AT THE SAME TIME GIVE TONE TO THE INTESTINES.

Salt.—Although not much known in regular and scientific practice, this article has been long used as a vermifuge. So early as the time of Celsus, it was recommended. In Ireland the use of it for this purpose is an old practice among the common people. In the same way it is also much used in this country. It gives tone to the digestive organs, and thus prevents the development of these animals, and in the next place destroys them by some deleterious agency.

The virtues of salt as an anthelmintic have received the sanction of the highest authorities. Brera speaks highly of it. Heberden does the same. Rush and Barton also commend it. It may be given in doses of from one ounce upwards, dissolved in a moderate quantity of water; also as an enema—the best form against ascarides.

Camphor.—Camphor is now in general use as an anthelmintic. It is not, however, a very new remedy. So long ago as the year 1759, an essay was written upon it by Pringle. On the worm itself, it would seem that camphor produces some deleterious effect, by asphyxiating or even destroying it. On the intestines it operates, too, very efficaciously in quieting irritation, and giving tone, and thus counteracting the tendency to the development of the verminous germs. Brera and Barton speak of it in terms of high commendation. It is against the lumbricoides that it has been chiefly found successful.

Mode of Administration.—The form recommended by Brera is to mix ʒss of camphor and ʒi of gum arabic in a pint of water. Of this a small spoonful may be given at a time. To children, to whom it is difficult to administer medicine by the mouth, it may be given in the form of injection, made by taking one or more ounces of the foregoing solution, and adding tepid milk according to the age of the patient. It is excellent in case of ascarides.

Arsenic.—In the form of the mineral solution, or Fowler's solution, this metal has been used with efficacy against the tænia. Dr. Fisher, of Massachusetts, by whom it has been chiefly used, recommended it as an

article which never has disappointed him in a single instance. He directs it to be taken two or three times a day in as large doses as the stomach will bear, and continue its use until the worms are destroyed. Do not follow this practice very far, or before the worm is destroyed the patient may be poisoned with arsenic.

SIALAGOGUES.

Medicines which excite the salivary glands and increase their secretion are called *Sialagogues.*

These are, according to their mode of acting, divided into *topical* or *remote.* Of the former, sometimes called masticatories, it is not my intention to speak; they are little used in medicine. Of the latter, *the remote sialagogues* or those which produce a salivary flow by specific action, there is but one which by the certainty and regularity of its action deserves special notice. This is mercury. The preparations of gold, antimony, and iodine sometimes produce this effect; it has followed occasionally the use of nitre and hydrocyanic acid. But it is an exceptional not a regular or constant effect. Under this head then I shall speak of mercury and its preparations only.

MERCURY (*Hydrargyrum, quicksilver, called by the Latins argentum liquidum, aqua argentea, etc.*).

Although known to the ancients, mercury was not by them used as a medicine. It is mentioned by Dioscorides, Pliny, and others, but always as poisonous. Its first use as a medicine has generally been credited to the Arabians, but Dr. Morrison informs us that it was used in China at a very early period, externally and internally, and as early as A.D. 745 it was termed by them the elixir of life. It was certainly used externally and internally by the Arabians; its innoxiousness is expressly asserted by Avicenna. To the great empiric Paracelsus can probably be attributed only the credit of popularizing what was previously known. The power of mercury to produce salivation was first discovered by a monk in the 13th century. In the 15th century it was first used (externally) to cure the venereal disease by Jacobus, an Italian surgeon. Calomel was first described by Crollius A.D. 1608.

Except for the venereal disease mercury was not extensively used till the beginning of the 18th century, when it was introduced into the treatment of febrile and inflammatory complaints. This practice took its rise in our own country, and it is to American physicians that is mainly due the credit of extending the use of this powerful agent. The circumstances under which it originated were the following:—more than a century ago (A.D. 1735) the American colonies were desolated by a most

fatal epidemic sore throat of a putrid character. It first appeared at Kingston, N. H., 1735, reached Boston in September, whence it progressed though very slowly westward, reaching the Hudson river in a little less than two years; hence it spread over the whole country, causing the most frightful ravages, especially in New England. Dr. Douglass of Boston states that one fourth of the inhabitants of that town took the disease and one in thirty-five died. In other places the proportionate mortality was very much greater—equalling one sixth, one fourth, and sometimes one third of those attacked. It was in combating this dreadful epidemic that mercury was first introduced into practice in the treatment of inflammatory complaints, and the credit of this great improvement is due to Dr. William Douglass of Boston. He used calomel and used it freely. By Dr. Jacob Ogden of Long Island the practice was carried to a greater extent, and his success was, in his own words, "beyond my expectations." He gave calomel to children in doses of 2 to 4 grains, to adults 6 to 8, repeated every twelve, eighteen, or twenty-four hours. From the success which attended the use of mercury in this disease it came very naturally to be used in others, and by the middle of the 18th century it was resorted to very frequently in pleurisy, pneumonia, &c. &c. When given as a cathartic large doses were admiuistered. As an alterative one or two grains were given combined with opium, camphor, or antimony, according to circumstances. From the foregoing brief sketch of the origin of the mercurial practice it is very certain that it prevailed here long before it was known in any other country. I have been thus minute because the credit of this practice is by Dr. Armstrong claimed for a Dr. Hamilton who, from Armstrong's account, first had his attention directed to it in 1764, a period at which it was in very general use in this country.

PHYSIOLOGICAL EFFECTS.

Local Effects.—These differ very much, according to the preparation of this metal which is employed. Some of them appear to produce little or no local effect, while others are actively irritant and caustic. In relation to calomel, much difference of opinion has been expressed. While by some it is supposed slightly irritant, others consider it rather as a local sedative. Mr. Annesley, in particular, has made some interesting experiments upon animals with the view of establishing this point.

Remote Effects.—These vary considerably with the manner in which it is used and also with the particular preparation which may be selected. The differences between the various preparations will be mentioned hereafter. At present, I shall only notice the general effects of this agent.

In *small repeated alterative* doses, the effect of the mercurials is to promote gently the secretions, but particularly those of the mucous sys-

tem. This they do without causing any sensible evacuations, and without producing any general disturbance of the system, provided their use be not continued too long.

In *larger doses*, they act more manifestly upon the secretions, augmenting those of the mucous membrane, exciting the liver, and causing evacuations from the bowels.

If the use of mercurials be persisted in, they produce general and permanent excitement of the system, causing what is commonly denominated *mercurial fever.*

Symptoms.—The pulse is increased in frequency—the blood when drawn has the buffy coat of inflammation, all the secretions of the system are increased, especially those of the salivary glands, and buccal mucous membrane, where we commonly find tenderness and inflammation, which with the augmented flow constitutes salivation or ptyalism.

The first symptoms of salivation are tenderness and swelling of the gums which become of a pale rose color, and at the part surrounding the teeth of a deep red. The soreness increasing, the tongue swells, the breath has a peculiar fœtor, and a styptic taste is perceived in the mouth. The salivary glands now swell and are tender, and there is a profuse flow of saliva and mucus from the mouth. To this, ulceration of the mouth often succeeds, and in severe cases the teeth are loose, and the gums gangrenous. The local irritation is accompanied with a degree of prostration which is sometimes dangerous and has proved fatal. Even in mild cases, fat is usually absorbed pretty rapidly and more or less emaciation results.

Remote Effects on the Mucous System.—The sympathy of action between different portions of the mucous membrane is perhaps in no instance so strikingly illustrated as in the operation of this agent. Its impression gradually extends itself to all parts of the system, until sooner or later not a ramification of this tissue in any part of the body remains unaffected. The membrane lining the alimentary canal, from the mouth to the rectum, as well as that lining the pulmonary, the uterine, and urinary organs, are all more or less influenced by it, and the general effect is to produce an increase of secretion from them. The evidences of this fact are so obvious as to require no illustration. In the alimentary canal we see it in the moist state of the mouth and in the increased evacuations from the bowels.

On the Glandular System.—Here the effect of mercury is still more marked even than it is on the mucous system. It excites into action almost all the secretory glands and increases in a remarkable manner the quantity of secreted fluids. The gland upon which this is first and especially exerted is the *liver*, as is shown by the change wrought in the character of the intestinal evacuations, which frequently assume a decidedly bilious hue, from the operation of a single dose of mercury. The *pancreas* is probably affected in a similar way, although we have not

the same striking evidence of the fact. On the *kidneys*, a like effect is produced. The glands, however, on which this effect is most palpably exerted are the *salivary*, which under the influence of this agent pour out continued and profuse evacuations.

Of the mode in which the glands are influenced two explanations may be given: the one referring it to a supposed law of the animal economy, that when the extremity of a duct is excited into action, the gland to which the duct leads is also similarly excited and an increased secretion takes place. Now all the excretory ducts communicate with the mucous tissue and are lined with prolongations of this tissue. Hence it is that the impression made upon the mucous membrane is transmitted to the various glands of the system. In this way the whole glandular system may be sympathetically called into action under the influence of mercury.

The other and more modern explanation is to attribute to mercury a special influence on the capillary system of the vessels, and to explain its action on the liver and other glands by the abundance of capillaries, by which their whole structure is pervaded.

On the Cutaneous System.—From the sympathy existing between the mucous membranes and the skin, articles that make an impression on the one are very apt to affect the other. This is the case with mercury. Its effect is transmitted to the cutaneous structure and exhibits itself sometimes in a simple increase of the natural exhalation from the skin, and at other times in an altered action of the part.

On the Nervous System, the effect of mercury is that of an irritant. If its use be continued for any length of time it disturbs the equilibrium of the nervous system, and frequently causes excessive general irritability.

On the Vascular System, the effect of this agent varies with the condition of the system and the quantity which may be given. If continued for any length of time it unquestionably acts as a stimulant to the circulation, and establishes throughout the system an excitement peculiar to itself.

On the Blood and Fluids.—When a patient is under the influence of mercury, the blood assumes the same buffy coat which it does in cases of inflammation, and according to the observations of some becomes of a much darker color than natural.* On the *saliva* it produces some striking changes. By Dr. Bostock, who analysed very carefully the saliva of a patient under full mercurial influence, it was ascertained that the character of it was very much altered, being changed from "the state of a mucous

* Dr. Ainslie says that after long-continued courses of mercury in England, blood drawn is not only more fluid, but darker colored, than when taken from a person in health.—Materia Indica, vol. i. p. 544.

[It is here that the true theory of the operation of mercury is to be sought—its influence on the blood; that it has such an influence—that under its use changes take place, is beyond doubt; but what those changes are, it is not, in the present state of our knowledge, possible to state.—Ed.]

to that of a serous, or rather an albuminous fluid;" and he supposes that the operation of mercury upon these parts is to counteract the ordinary secreting process, and to reduce the action of the glands to that of mere transudation. He also suggests, that as one operation of mercury is to change a mucous to a serous fluid, whether we may not conceive that the action of this remedy in the cure of glandular obstructions consists simply in producing this change of secretion; and whether even in the removal of the diseases of surfaces, mercury may not operate upon the same principle, by counteracting the effect of specific secretions, and reducing them to the mere transudation of a serous fluid. Dr. Ure found that ordinary saliva contained a peculiar acid, the *sulpho-cyanic acid*, which was not present in the saliva which flows during mercurial salivation.

Circumstances Modifying these Effects.—With the different conditions in which the human body is found, the effects of this agent vary very considerably. In a practical point of view these variations are exceedingly important.

Age.—It is a fact supported by abundant observation, that children can bear larger proportionate doses of calomel than adults. This may be owing probably to the intestines at this early age being more commonly lined with mucus, which prevents the absorption of the mercury. Another fact equally well established is that infants are not so readily salivated as adults. Indeed in children under two or three years of age salivation is a very rare occurrence. Maunsell says "we have never succeeded in salivating a child under three years old," p. 68. Dr. Rush, in speaking of its use in croup, states that "he never knew it excite a salivation when given to children whose ages rendered them subjects of it."* Dr. Warren of Boston says, "I have never known an infant to be salivated, notwithstanding I have given in some instances large quantities with this view."† The same appears to be applicable to the external use of it. Dr. Percival remarks that he "repeatedly observed that very large quantities of the unguentum ceruleum may be used in infancy and childhood, without affecting the gums, notwithstanding the predisposition to a flux of saliva at a period of life incident to dentition."‡ When, however, they do become salivated, as is sometimes the case, its effects are most disastrous. Sloughing of the gums and cheeks, general prostration and death not unfrequently occur. Dr. Blackall remarks, "a general opinion prevails that the constitutions of infants resist mercury in a remarkable degree. Its entrance into the system they certainly do resist more than we could expect; but they are

* Obs. and Inqs., vol. ii. p. 379.

† View of the Mercurial Practice in Febrile Diseases. By John Warren, M.D., p. 146.

‡ Percival's Essays, vol. ii. p. 318.

greatly overcome by salivation; and the possible occurrence of such accidents may well set us constantly on our guard."*

2. *Sex.*—As a general rule, females appear to be much more readily affected by mercury than males. On this point a striking fact is recorded by Mr. Carmichael. He states that on his first appointment at the Lock Hospital in Dublin, he made no distinction between the quantity used whether for males or females. He soon found, however, that in females this was constantly followed by excessive salivation, attended with dysenteric affections, extreme debility, and sometimes dropsy, while in males none of these effects ensued. On using half the quantity, this was obviated, and at the same time the full mercurial effect obtained.†

3. *Temperament and Constitution.*—This modifies very greatly the effect of this agent. Nervous and irritable habits as a general rule bear very badly the operation of this metal. Indeed, if carried to any extent in them, it is very apt to be followed by effects exceedingly distressing and injurious. Among these the most common and marked are restlessness, anxiety, and a general increase of constitutional irritability, predisposing the system to the invasion and development of various diseases. Mr. Travers states that he has "seen in more than one instance, acute pneumonia, and in another mania, set up by the excitement of mercury, which proved speedily fatal, without any previous organic disease, or prohibitory disposition."‡ Tremors and paralysis have also been known to result from its long continued use. Dr. Falconer of Bath says, "I have seen repeatedly from this cause (the use of mercury) such a shocking depression of spirits, and other nervous agitations with which it was accompanied, as to make it more than merely probable that many of the suicides which disgrace our country were occasioned by the intolerable feelings that result from such a state of the nervous system."§

4. *Climate and Temperature.*—Although warm climates and the warm seasons of cold climates are considered most propitious to the administration of mercury; yet it will be found much more difficult to bring the system under its influence under these circumstances. It is on this account that so much larger quantities are required and used in tropical regions, and the reason doubtless is the great tendency which there is to the skin, diverting its action from other parts. Mr. Ainslie says, this was so commonly observed in the East Indies, that he was "in the habit of recommending those who could do it with convenience, to remove during the time they

* Blackall on Dropsy, p. 126.

† An Essay on Venereal Diseases, &c. By Richard Carmichael, M.R.I.A., p. 307.

‡ On Constitutional Irritation. By Benj. Travers, F.R.S., &c., p. 21, Am. Ed.

§ Transactions of the Medical Society of London for 1809. Hamilton on Mercury, pp. 14, 15. Ainslie's Mat. Med., vol. i. p. 648. Carmichael on Venereal Diseases. Edited by G. Emerson, M.D., p. 302.

were using it (mercury) to some cool situation."* In the days of Sydenham, it was customary to send syphilitic patients to the south of France, as experience had proved that large quantities of mercury could in that climate be introduced into the system, without producing salivation.† As a general rule, it may be laid down, that a constant and active determination to the skin always interferes more or less with the specific action of mercury on the salivary glands. Hence it is that Plummer's pill is less likely to salivate than some of the other preparations of this metal.

Independently of mere temperature, certain regions seem to be adverse to the kindly operation of this metal on the human system. In Egypt, according to Baron Larrey, the use of it, even in the venereal disease, requires the greatest caution; if applied with the same freedom as in Europe, it produces fatuity, hepatic disorders, &c.‡

Mr. Ferguson, Inspector-General of Hospitals in the Portuguese army, states, that in the soldiers composing the British army in Portugal, venereal ulceration was not only more intractable to the operation of mercury than under similar circumstances at home, but the constitution, while strongly under the influence of the remedy, became affected with secondary symptoms in a proportion that could not have been expected.§

5. *Habit.*—Unlike many other medicines, the system does not become habituated to the use of mercury, so as to require an increase of quantity to produce its effects. On the contrary, after the system has been once fully affected by it, much less will produce its effects. Mr. Carmichael says on this subject, "When a patient, whether male or female, has been salivated several times, and the system, therefore, habituated to mercury, it is incredible the small quantity of that mineral that is sometimes capable of exciting the severest effects."‖ Persons, too, who have gone through several courses of mercury, and whose constitutions are impaired, often suffer greatly during a mercurial course. Profuse salivation, dysentery, and great debility are frequent occurrences. In the English and Irish hospitals this is constantly observed.¶

Swediaur remarks, that "those who have previously taken mercury, are often ready to fall into a salivation by using the smallest dose, though perhaps in the former disease they experienced no such effect from the use of it."** Several cases which have fallen under my own observation confirm the correctness of this opinion.

* "For instance, if in the Carnatic, that the patient should proceed to the Mysore country, or to the delightful and cool valley of Courtelam, in the Tinnivelly district." —Mal. Ind. vol. i. p. 554.

† Thomson's Mat. Med. vol. i. p. 396.

‡ Memoirs of Military Surgery. Translated by R. W. Hall, M. D. & P. vol. i. p. 144.

§ Medico-Chir. Trans. of London, vol. iv. pp. 1, 2.

‖ Carmichael, p. 308. ¶ Ibid. p. 307. ** On Syphilis, p. 381.

6. *Hospital or Private Practice.*—Whether the mercury be administered in venereal hospitals or in private practice makes a great difference in the effect. In general, much smaller quantities are required to affect the system in an hospital than in ordinary practice. This may be owing partly to the well regulated temperature of an hospital, but more especially to the atmosphere being impregnated with mercurial vapor. Mr. Carmichael states, that one or two ounces of ointment were found sufficient in the Lock Hospital of Dublin, not only to cure the disease, but to keep up an irritation in the system for one or two months.*

7. *Actual state of the System as to Disease.*—Of all the modifying circumstances this is one of the most influential. Certain diseases seem to resist the mercurial impression; of these, mania is one. Very large quantities of calomel have been given to insane persons with very slight obvious effects. Elliotson gave nine ounces of calomel in six months to a young man, with very moderate salivation as the only result.

Croup.—Here too immense doses of calomel have been given without obvious effects. On the other hand, in scrofula, moderate ptyalism will often produce the most disastrous consequences.

[Is it not probable that in many of these cases, where calomel was given in such uncommon doses, though it failed of its immediate effect on the salivary glands, it may yet have produced a slow and imperceptible poisonous influence? Or are we to suppose that these frightful doses pass through the intestines without any of it being absorbed?—Ed.]

PATHOLOGICAL EFFECTS OF MERCURY.

Having spoken of the ordinary medicinal or physiological effects of mercury, I will devote a few words to two of the diseases which are most confidently attributed to the agency of mercury.

1. *Erythysmus mercurialis.*—This was first noticed by Pearson at the Lock Hospital; the symptoms are depression of strength, a sense of anxiety about the præcordia, frequent sighing, trembling, irregular action of the heart, pulse small, quick, and occasionally intermitting, vomiting, a pale contracted countenance. When these symptoms were present, any exertion, as walking rapidly across a room, rising suddenly from a chair, has instantly destroyed life. The affection does not at all depend on the quantity of mercury taken, or on the presence of salivation.

2. *Eczema mercuriale.*—Called also erythema mercuriale, lepra mercurialis, hydrargyria, erysipelas mercuriale. The disease occurs about eight or ten days after the beginning of a mercurial course; it is ushered in by heat and itching, first felt about the scrotum, thighs, groin, and bend of the

* Carmichael on the Venereal Disease, p. 116; also p. 302.

arm. These parts are rough and faintly red. Though the disease spreads over the whole body, yet the lower extremities are usually attacked before the upper; the anterior portion of the body before the posterior. There is some swelling of the parts, frequent pulse and white tongue. The eruption is vesicular, the vesicles very minute, though in the progress of the disease they attain the size of a pea. When ruptured, they are commonly followed by irritable excoriations, from which a fœtid discharge follows. This continues but a few days, when the sores dry up, then brown or black scales form and fall off, leaving a red surface. Sometimes the hair and nails fall off. The disease runs its course in from ten days to as many weeks; it rarely proves fatal. Like the previous disease, it does not seem to depend upon the quantity of mercury given, nor is it connected in any way with salivation. It is sometimes caused by a single small dose of mercury, and has resulted from the accidental application of a few grains of red precipitate to the skin, also from the use of black wash.

[Neither of these mercurial diseases is very common, but it must not be supposed that because a patient escapes them, he is not injured by a salivation. The impression which this poisonous mineral makes upon the system that is saturated by it, has a thousand different forms, and affects any or all the functions. No man has, after a mercurial course, the same integrity of constitution he had before.—Ed.]

STATES OF THE SYSTEM UNFAVORABLE TO THE USE OF MERCURY.

From what has been said of the effects of mercury, it is evident that it cannot be used with advantage, nor even with safety, in all states of the system. This, though so obviously true, is too often disregarded in practice; it is still too much the habit to use mercury as a specific, and to introduce it into the system without regard to anything but the quantity that can be given. The mischiefs resulting from such a use of mercury are incalculable, and have associated its history with many a tragic record. These errors, though not now as common as formerly, are not entirely eradicated. There are, then, certain states of the system in which the constitutional effect either cannot at all be produced, or is attended with great danger—these are,

1. Plethora and great vascular excitement. This condition must be essentially modified by venesection, or other appropriate means, if we desire to use mercury either effectually or safely.

2. A congested state of any important organ, as the brain, attended with an oppression of the general system, torpor, languor. Here venesection, revulsives, &c., should precede mercury.

3. A debilitated state of the system, attended with great nervous irritability, is especially unfavorable to the use of mercury. If given at all

freely, mercurial fever or some other pathological effect of the drug is almost sure to follow, while, if proper means be first taken to invigorate the system, and allay excessive irritability by the judicious use of tonics, opiates, and nervines, mercury may be given with a fair prospect of obtaining its legitimate curative effects.

4. A scrofulous habit of body, or the existence of a marked predisposition to pulmonary consumption. This state of things most strongly contra-indicates the use of mercury. If a phthisical patient is obliged to go through a mercurial course, his pulmonary difficulty is almost always aggravated. This is seen very often in venereal hospitals, where, in addition to the internal use of the metal, the patient lives in a mercurial atmosphere.

5. A scorbutic habit, or a constitution broken down by intemperance and other bad habits, forbids the use of mercury, except under most extraordinary circumstances.

6. The existence of a peculiar susceptibility to the pathological effects of mercury. This, as I have said, probably depends on some peculiar idiosyncrasy, and can only be known to exist by experience; but where it is known the case must be very peculiar to justify us in rushing upon an evil so great and so certain as the pathological effects of mercury; the mischief thus done is often, perhaps generally, irreparable. All these remarks you will, of course, understand as applying to the continued use of mercury, with a view to its alterative or so called constitutional effects, and not to its occasional use as a purgative.

MODES OF INTRODUCING MERCURY.

1. *By the Stomach.*—This is the common mode, and generally answers very well. Sometimes, however, it irritates the bowels and produces purging; and when this is the case, it is difficult to secure the constitutional effects. This is obviated by combining with opium. Sometimes, however, this does not answer, and then other modes of administering it are resorted to.

2. *By Friction.*—Rubbing the ointment on the surface. This was the earliest mode of using mercury for the cure of syphilis. The advantages of these are—

(*a.*) It affects the system more certainly than giving by the mouth.
(*b.*) It produces its effects in a shorter time.
(*c.*) We avoid griping or purging.

The objection to its use in this way is the trouble and uncleanliness.

Rules.—The part on which it is rubbed should be first well washed with soap and water, and then from half a drachm to a drachm rubbed on by gentle friction for twenty or twenty-five minutes. This to be repeated

daily, and when the patient is able to do it, it should be performed by himself.

3. *Fumigations.*—This was a mode formerly practised, but not much in vogue at present.

In using this the patient is first undressed, and then put into a box with an opening at the top to let out his head. In the bottom of the box is a small grate with a heated iron in it. On this the mercurial preparation is thrown, and thus converted into vapor. This vapor surrounds the whole body and thus by direct application to the skin produces its effects.

Various mercurial preparations have been used for this purpose. The first was *cinnabar*. This, however, proved exceedingly injurious from the evolution of sulphurous vapor which was apt to be inhaled. Mr. Abernethy used a powder prepared by adding ℥vi. of distilled water to ʒij. of aq. ammonia, and then throwing ℥iv. of calomel into the liquor, and then shaking it. On filtering and drying a grey powder was left. This, he says, contains a good deal of quicksilver in a metallic state, but which becomes oxidized on being converted into vapor. Dose, half an ounce a day.

(*a.*) This mode affects the system more rapidly than any other; and frequently does so when all other means have failed. It is useful when the speedy operation of mercury is necessary.

(*b.*) The objection to it is that it brings on ptyalism before a sufficient quantity of mercury is introduced, and that it causes sometimes debility and prostration.

M. Ricord, at the Hôp. du Midi, makes very frequent use of mercurial fumigation in old syphilitic cases. He uses cinnabar, volatilized in a small furnace; the fumigations are continued from a quarter to half an hour.

4. *Inhalation.*—This mode was practised during the cholera in this city. This is done by having a tin vessel with a bar of hot iron in it. To this was attached a flexible tube, one end of which was in the patient's mouth. Ten grains of the grey oxide thrown every few minutes on the hot iron and inhaled, it salivates in a few hours.

MODES OF JUDGING WHETHER THE SYSTEM IS AFFECTED BY MERCURY.

1. Salivation.—This is the most certain test. Sometimes, however, this is produced by a minute quantity of mercury, and then no test.

2. The Character of the Stools.—This is of great importance to show the effect of this agent on the hepatic and intestinal secretions. When the evacuations are of a *dark grey color*, it is a proof that the article acts merely on the intestinal canal. When they become *yellowish* it proves that it has acted on the liver. The *green color* of the stools which

is so common when calomel has been given is owing not to the calomel directly, but to the intermixture of bile from the liver and gall bladder with the tough viscid secretions of the intestines. When, therefore, these evacuations appear, it is a proof that these organs have been excited into action and evacuated. Now, in many cases of diseases of children this is important. Young children you know cannot be salivated, and this then becomes an important indication as to the extent and kind of action produced. In croup these are the kind of evacuations which generally give relief.

3. The Abatement of the Disease for which the Medicine was given.—Do not rely too much upon any of these tests of the operation of mercury, but watch the patient, and if the mercurial irritation appear, even in a slight degree, stop the use of the drug. Especially is this important in children.

Salivation.—As this is one of the most curious and interesting of the effects of mercury, it ought to be specially studied. It has been a question much disputed whether it is merely the evidence of the system being affected, or whether it is also curative. I believe it is powerfully curative as an irritant and depletant.

There are two points in relation to salivation of practical importance.

1. *The time required to produce it.* This varies greatly according to the *peculiarity of the constitution*, the *nature of the disease*, and the *mode of using the mercurial.* With regard to constitutional peculiarity there is every difference. In some cases, the smallest quantity will produce salivation, and that in a very short time; sometimes in the course of twenty-four hours. In other cases, the exhibition of the remedy for weeks and even months will fail to produce this effect.

The state of the system, too, as to disease, causes a great deal of difference.

Then the preparation used makes a difference. Calomel and blue pill salivate more readily than corrosive sublimate. By combination too, with opium, the effect may be facilitated.

2. *Excessive Salivation.*—Salivation once excited is exceedingly uncertain in its effects—sometimes excessive—producing ulceration and great prostration. Owing first, to some constructions being especially susceptible of its action; second, to its accumulating in the system without producing any manifest effects, when it suddenly bursts forth with great violence. Under these circumstances the patient usually suffers greatly and for a long time. The treatment must be both constitutional and local.

Constitutional.—1st. Purging. This lessens the general irritation, and derives from the mouth, but as it increases debility it is only to be used where the patient has some strength. 2d. Opium. This relieves pain,

allays irritation, and will sometimes diminish the secretion. 3d. Iodine has been used as a sort of antidote to mercury; its powers are more than doubtful.

Local.—A great variety of washes and gargles have been used as remedies for mercurial sore mouth. Infusions of green tea and other mild vegetable astringents; the water infusion of opium, lime-water properly diluted, solutions of carbonate soda, sugar of lead, &c., &c.

MODES IN WHICH MERCURY PROVES CURATIVE.

These are various, differing according to the extent to which it is carried.

1. By acting simply as a cathartic. As has been already intimated, mercurial cathartics, especially calomel, operate in a way peculiar to themselves, promoting hepatic and intestinal secretion in a way which no other articles do, and it is by this peculiar action that it proves so salutary in many cases—relieving hepatic congestion and proving revulsive from other parts of the system.

2. By its peculiar effect in promoting secretions from the mucous membrane.

3. If its use be continued long enough to bring the system fully under its influence as evidenced by ptyalism, it promotes the secretion of the extreme vessels in every part of the system. In this way it relieves unequal distribution of blood by the uniform and permanent determination of fluids which it keeps up to these extreme vessels, and produces a general change of action in the secretory and absorbing vessels. This latter is what is usually called the alterative effect of mercury.

4. Promoting absorption.

5. In some cases, it proves curative by its effects on the salivary glands acting on the principle of revulsion.

Lastly, in syphilitic diseases, it appears to prove curative by some specific agency.

MODUS OPERANDI OF MERCURY.

Is mercury absorbed?

That it is absorbed we prove

1st, By its having been found in the blood and the various secretions, as saliva, bile, urine.

2d, Metallic mercury has been found after death in the bones, brain, &c. How it is reduced we know not.

3d, When given by the mouth, if it purge, salivation is prevented, the purging interfering with its absorption.

4th, Nursing infants have been cured by giving mercury to the mothers.

5th, States of the system favorable to rapid absorption favor the production of the constitutional effects of mercury. Other arguments might be adduced, but the matter, though till of late fiercely debated, is now settled, no one doubts the absorption of this as of other medicines.

PRACTICAL APPLICATIONS OF MERCURY IN THE TREATMENT OF DISEASES.

There is perhaps no one article of the materia medica concerning which there has been so much difference of opinion as the use of mercury in various diseases. By some it is reprobated as an agent profoundly deleterious to the constitution, while by others it is looked upon as the panacea for almost every disease. By impartial and experienced observers both these extremes must be viewed as equally erroneous. That the profuse and indiscriminate use of it which has been too common has been productive of great mischief cannot be questioned. At the same time it is equally unquestionable that by its judicious use many diseases are controlled and subdued which otherwise are wholly unmanageable. Even in these, however, it depends in a great measure upon the manner in which it is used, whether it proves salutary or otherwise. For the purpose of illustrating this, I shall notice its use in some of the more important classes of diseases, and in doing so, I shall endeavor to point out the general principles upon which it is to be prescribed.

Fevers.—The principles upon which mercury may prove beneficial in this group of diseases are the following :—

In the first place, there is generally present in fever a congested state of the liver and abdominal viscera, in consequence of which the secretions of these organs are interrupted and sometimes changed in their character.

In the second place, in fever, the whole of the mucous tissue and especially the mucous tissue of the alimentary canal becomes deranged in its secretory functions.

In the third place, irregular distributions of blood take place in different parts of the system, showing themselves sometimes in one organ and sometimes in another either in the form of inflammation or of simple congestion.

Now these are among the prominent conditions of the system observed in fevers, and it is for the correction of these that mercury may be rendered available and it operates in the following ways.

1. It acts on the liver and other abdominal viscera, and promotes the secretions from these organs. The evidence of this is seen in the altered condition of the evacuations from the bowels.

It acts on the whole of the mucous tissue of the alimentary canal, and excites the whole of the secretory apparatus of this tissue.

3. If its use be continued long enough to bring the system fully under its influence, it promotes secretion from all the extreme vessels of every part of the system. In this way it relieves unequal distributions of blood, by the uniform and permanent determination of fluids which it keeps up to these extreme vessels. These are the two ways in which mercury proves beneficial in fevers—in the first place, by certain effects which it produces on the abdominal viscera, and secondly, by its general action on all the secretions. In every case of fever it is by no means necessary to carry its use so far as to produce all these effects. In some cases, all that is required is to obtain its effects on the abdominal viscera and the mucous tissue; while in others no good is done until the whole system is brought under its influence. This will be sufficiently illustrated by briefly noticing the different forms of fever.

Intermittent Fever.—In this form of fever there is always more or less of disorder of the bowels, and not unfrequently of the liver. The former become torpid in their action and deranged in their secretion, while the latter is often congested, and as a consequence, impeded in its function of secreting bile. Hence it is that the discharges from the bowels are scanty and unnatural, and there is a sense of fulness and oppression in the epigastric region. That these symptoms should arise is what might naturally be expected, from what takes place during the paroxysms of this fever. Thus, during the cold stage, the general recession of blood from the surface, and the congestion of the large organs and blood-vessels, particularly those of the abdomen, during the hot, the general reaction and febrile excitement, all are calculated to produce just such disorder of the liver and intestines as we find present in this disease. If the paroxysms have been frequently repeated, the disorder of the abdominal viscera will be proportionally aggravated, and become more or less chronic. Now, before the disease can be radically cured, this condition of the abdominal viscera must be corrected by the use of appropriate medicines. Among these, cathartics are means most valuable, and of them the most efficient is *calomel*, aided by other agents to carry off the secretions which it produces. When properly given, and when it produces its legitimate effects, calomel excites the action of the torpid and congested liver, and promotes the secretion of the mucous membrane of the intestines in a way which no other article does. The best mode of giving it to promote these effects is to administer a large dose, say ten or twenty grains, and in the course of five or six hours to follow this with castor oil or senna and Epsom salts, to carry off more completely the morbid contents of the intestines. In many cases a single dose will answer every purpose; sometimes, however, it will require to be repeated, and more than once. Now, the object of all this is not to arrest the fever, but simply to prepare the system and

especially the abdominal organs, for the administration of tonics. If this course has been pursued, as a general rule, it will be found that a few doses of cinchona or quinine will readily arrest the progress of the fever. On the other hand, if this preliminary action on the abdominal viscera has been neglected, the operation of tonics will be always more or less uncertain.

In ordinary cases, therefore, of intermittent fever, the only use that it is desirable to make of mercury is to obtain its effects as a cathartic on the liver and intestines, with the view of preparing the system for the subsequent action of tonics.

In some cases, however, the use of this agent requires to be carried further. When the paroxysms have been repeated for a length of time, and as a consequence permanent obstructions have taken place in the abdominal viscera, it becomes necessary to make a more decided impression on the system, and even to carry it to the point of ptyalism. For this purpose, the blue pill may be given at night, and followed in the morning by mild laxatives, and continued until the desired effect is produced.

In relation to the effects of mercury, when given alone in this fever, Dr. Johnson gives the following interesting fact. He states that in two ships of war in the East Indies, in consequence of the great number of intermittents, the bark had been entirely expended, and in this dilemma their only resource was mercury; "and, though this medicine," he adds, "invariably stopt the paroxysms as soon as the system was affected, yet three fourths of the patients treated on this plan relapsed as soon as the effects of the mercury had worn off, and that after three, and in a few instances four, successive administrations, so as to excite ptyalism."*

Remittent and Bilious Fever.—In these forms of fever, the value and efficiency of mercury as a general remedy, is established beyond all doubt. In the East Indies, where they prevail to so great an extent, the concurring testimony of the most intelligent practitioners unites in pronouncing mercury indispensable, and in fevers of our own country it has been found no less so. Among the symptoms characterizing these forms of diseases, there are none more striking than those which indicate a congested condition of the abdominal viscera, and a deranged state of the stomach and intestines. There is always more or less oppression at the præcordia, sickness, vomiting, together with costiveness, and a vitiated state of the intestinal secretions. To correct these there is no agent so valuable as mercury. Having premised venesection more or less extensive, calomel is to be given in large doses, say of ten or twenty grains, and repeated according to circumstances, for the purpose of acting on the liver and restoring the secretion of that organ, and also on the mucous membrane of the intestinal canal, with the view of separating mucous accumulations and changing the secretory action of the membrane. While giving calomel in this way, it will be

* On Tropical Diseases, vol. i. p. 139.

necessary to interpose occasionally some brisk cathartic to carry off more effectually the morbid secretions from the intestinal canal, and for this purpose castor oil or a combination of salts and senna are the best. In this way, not merely the immediate effects of the mercury on the abdominal viscera are more thoroughly secured, but the eventual operation of this agent on the system at large will be more speedily and certainly brought about.

The objects, then, for which calomel is administered in this form of fever, thus far, are very much the same as those in intermittent fever, viz.—to produce certain effects on the abdominal viscera, and prepare the way for tonics. In many cases, however, it will be necessary to extend the use of it still further, with the view of bringing the system at large under its influence, as evidenced by the development of ptyalism. When this shows itself, the case may generally be considered as out of danger. For this purpose calomel may be given in doses of five or six grains, and repeated every six or eight hours. During the exhibition of the remedy in this way, care must also be taken to evacuate the bowels regularly, by the interposition of some active cathartic. One of the great advantages of this mode of treatment is, that it prevents those chronic affections of the liver and spleen which are so apt to occur as the sequelæ of fever, under other treatment.

In this form of fever, therefore, mercury may be used to fulfil all the objects which it is capable of accomplishing.

Continued Fever.—Mercury is also used, and frequently with great advantage, in this form of the disease. The primary object for its use here is, to obtain its peculiar effects upon the liver and intestines, and this is to be done by the administration of doses of six or ten grains, followed by suitable cathartics. This may be repeated according to circumstances, until the evacuations assume a more natural and healthy appearance. With regard to the continuance of the remedy after this with a view to obtain its general effects on the system at large, as indicated by ptyalism, the practice is more doubtful. When no particular determination exists to individual organs, and where the vascular excitement is very great, as a general rule, mercury is not a suitable remedy. On the other hand, where local congestions are present, and especially congestions of the abdominal viscera, there is no remedy which, by its general action on the secretions, is so efficacious in equalizing the circulation and breaking up these congestions. In some cases, too, where blood-letting and other evacuant remedies have been carried to their full extent without arresting the disease, mercury given with a view to its specific and alterative effects sometimes proves eminently successful.

In true typhus, if mercury is to be used at all, which is very doubtful, it must be with very great caution, and early in the disease. Later, it is certain to do nothing but harm. As a general summary of the true practice

in fevers, I state that mercury in intermittent and remittent fevers is not to be used as a specific. You want the effects of calomel on the secretions of the bowels and liver, to restore these to health, not that such restoration of the secretions will always check the fever, but they prepare the system for other remedies. Now, this effect of mercury on the secretions may very often be produced by one purgative dose of calomel; in other cases, more protracted, or originally more severe, several purgative doses may be necessary. In a few cases we may, by the severity of the congestive affections, be obliged to go so far as to get the constitutional effects of mercury; but remember in all these cases, it is not to be used as a specific, but to prepare the way for tonics.

INFLAMMATION.

There is no class of diseases on which the efficacy of mercury is more triumphantly shown than in inflammations. This is, as I have before stated, an American practice. In these cases, we use it with a view to its general alterative effect; and when the system is put fully under its influence, it exercises a wonderful power in arresting the progress of inflammatory action. In consequence of this, it is called an anti-inflammatory agent. A beautiful illustration of this is afforded in *iritis.*

How mercury does this we cannot exactly say, probably by some change in the blood. The fact however we know; it is the result of observation. Calomel is the preparation commonly used, and we repeat it until the system is affected. It is, however, not equally useful in all inflammations; in some indeed, it is injurious, especially in scrofula, cancer, fungus hæmatodes.

Tonsilitis.—In ordinary inflammation of the tonsils, calomel may be used with great advantage. After suitable depletion it should be given in a large dose, say ten grains, and followed after an interval of five or six hours by castor oil or some other mild laxative. In this way, it operates beneficially, in two modes:—first, by creating a new action in the liver and mucous membrane of the alimentary canal, upon the principle of revulsion; and second, by the peculiar effect which it has in restoring the secretion of the mucous membrane of the part inflamed. In consequence of this latter effect, it will not unfrequently be observed that a single dose of calomel will produce a complete change in the character of the fauces, causing a moist state of the inflamed parts and lessening the redness and tumor.

Laryngitis.—This disease may be either acute or chronic, and in both calomel is an agent of great value. To be really useful, however, it should be carried to salivation. When this effect is produced, the case generally terminates favorably and it operates no doubt in a great measure by the free secretions which it produces from the mouth and fauces as well as by the

counter-irritation which it occasions in the gums. In the acute form, from the great rapidity with which the disease runs its career, the great difficulty is to gain sufficient time to produce the proper mercurial effect on the system. In cases of this kind, therefore, after the depletion, it is to be introduced as speedily as possible and in as large doses as the system will bear. In the chronic form, abundance of time is allowed for its more gradual introduction. The utility of calomel in both these forms is established by unquestionable experience.

In inflammation of the glottis arising from the inhalation of steam, calomel has proved eminently successful. Several interesting cases of this kind are related by Dr. Wallace which were treated by giving to a child two grains of calomel every half hour or hour.

Trachitis.—There is no form of inflammation in which mercury has been more celebrated than in this. Who first suggested it cannot be determined with any degree of certainty. It is, however, unquestionably an American practice, and was in extensive use in this country during the last century. With regard to the operation of this agent in this disease, it appears to be well established that no great relief is afforded by it until evacuations of a peculiar character are produced. These evacuations are of a dark green color resembling in their general appearance boiled spinach, and they are, as before stated, combinations of bile and mucus. To produce these, calomel must be given in large and repeated doses; from 3 to 5 grs. at a dose, repeated every two, three, or four hours. Frequently it is only after the exhibition of 30 or even 50 and in some cases 100 grs. in this way that such discharges are obtained. They are always followed by a manifest amelioration of the disease, and from the difficulty of producing salivation in young subjects fortunately this result very rarely follows the use of such large quantities of this article. Of the manner in which calomel accomplishes its purposes in this disease I have already spoken under the head of cathartics.

Bronchitis.—In this variety of inflammation, whether acute or chronic, calomel frequently proves exceedingly beneficial. In the former it may be used at first as a cathartic and after this with a view to its alterative effects. In the latter, i. e. the chronic form, it is of more doubtful efficacy. By judicious combination, however, with opium and antimony it may be used sometimes with great effect as an alterative—changing gradually the condition of the mucous membrane of the bronchi and eventually effecting a cure.

Dysentery.—In this disease mercury is a remedy of inestimable value. Associated with inflammation of the intestines there is generally a disordered condition of the liver, as is shown in the absence of bile. In the treatment one of the great objects is to restore the healthy secretion of the liver, and nothing does this so effectually as calomel. Besides this, it acts peculiarly on the mucous membrane of the intestine itself, lessening inflam

mation and promoting secretion. In addition to all this, if carried so far as to affect the gums, it acts still more powerfully in the progress of disease. With regard to the mode of using calomel in this complaint, there is considerable difference of practice. By some very large doses are used, while by others small ones are preferred. The mode I prefer is, after suitable depletion, to give one or two large doses of 10 or 20 grs. at first to obtain if possible a decided cathartic effect, and after this to trust to smaller and repeated doses for the purpose of producing its alterative effects on the system. Should the gums become touched the patient may generally be considered free from danger.

Pleurisy and Pneumonia.—The great remedy here of course is venesection carried to the extent of producing a decided impression at once on the system. After this, to subdue whatever inflammatory action may still remain as well as to counteract the consequences of inflammation in the way of effusion, there is no remedy so effectual as calomel with the view of affecting the mouth. In those cases in which the venesection, although carried as far as can be justified by the strength of the constitution, is yet unable to subdue the disease, calomel is the only remedy which can be depended upon.

Pericarditis.—The first and great remedy in this disease is venesection, with the view of impairing the action of the heart.

This, together with other antiphlogistic means, such as cathartics, antimonials, &c., may do much in mitigating the violence of the disease. Alone, however, they are not always adequate to effect a cure. They may arrest the inflammation, but they cannot prevent some of the consequences of it. Effusion may have taken place, and to produce absorption the agency of mercury is required. To obtain all its salutary effects it must be carried to the extent of affecting the gums, and this ought to be done as speedily as possible. For this purpose calomel is to be administered in doses of five or six grains three times a day, combined, if necessary to prevent purging, with suitable proportions of opium. To obtain the full effect too, it is desirable to keep the gums sore for some days.

Hepatitis.—There is no form of inflammation in which the peculiar powers of mercury are more strikingly illustrated than in this disease. After due depletion it is to be resorted to with the double view of promoting secretion from the liver and eventually producing its general effects on the system as indicated by salivation. In habits broken down by intemperance, where depletion cannot be carried safely to any great extent, as well as in persons advanced in years, it is the only remedy to which the safety of the patient can be trusted, and in these cases it sometimes operates with wonderful efficacy.

Rheumatism.—In this disease, both acute and chronic, the use of mercury has been greatly lauded, but it is to be feared too indiscriminately. In the acute form, as a general rule, calomel should be used only as a

cathartic. In this way, aided by other cathartics, it proves exceedingly useful. Carried however so far as to produce salivation, little or no good is to be expected from it. Mackintosh says, "I have often seen the tongues of patients swollen and ulcerated and profuse salivation induced without the least signs of amendment."* Scudamore says that if used so "as to produce mercurial fever, its effects are sooner or later injurious."† I have met with one or two cases in which salivation occurred and yet without any amelioration of the disease. Besides this, it is supposed by some and perhaps with reason, to increase the susceptibility of the patient to a relapse.

In chronic rheumatism, an alterative mercurial course, so as to touch the mouth, in some cases proves useful, although as a general remedy it is not to be depended upon. When it has any connection with syphilis, mercury becomes essential. There is another form of chronic rheumatism in which a mercurial course is of great service, and that is when it arises from imprudent exposure to cold during the use of mercury.

This was originally noticed by Dr. Bradley, in 1806, who states that he met with several cases of rheumatism which attacked persons while under the influence of mercury, for the cure of complaints totally unconnected with syphilis. In these cases, all the ordinary remedies failed, and they were only cured by having recourse again to mercury till the mouth became affected, and as soon as this took place, the complaint yielded.‡ Dr. Scudamore confirms this observation and he says, "I have in every case of this kind, seen that all the ordinary methods of treatment are of no avail, or afford only palliative and very temporary relief; but I have invariably had the satisfaction of witnessing the cure to be effected by resuming a well conducted mercurial course.§

In *Gout* the utility of mercury depends entirely upon the mode in which it is used. If given simply as a cathartic, or in moderate quantities to produce an alterative effect on the secretions of the liver and intestines, it proves of great advantage. When carried so far as to excite mercurial fever or to salivate, it invariably does harm by increasing the general irritability of the system, prostrating the patient's strength, and even increasing or bringing back the gouty paroxysms. Several cases of this kind are related by Scudamore.

* Practice of Physic, vol. ii. p. 420.

† Scudamore says, "in very numerous instances in which I have witnessed the result of a combination of calomel, antimony, and opium, when given in repeated doses at short intervals, however favorable its operation at the time of its employment may have been, it has appeared to increase the suceptibility of the patient to a relapse." P. 299.

‡ Med. Reports, &c. by S. A. Badsley, M. D. p. 43. Lond. 1807.

§ P. 103. He also thinks that gouty habits are more easily affected by mercury, p. 103.

Iritis.—In this form of inflammation the use of mercury is essential, and there is no affection in which its efficacy is more beautifully illustrated. Along with suitable depletion, it is the only remedy on which we can depend for arresting the progress of inflammation as well as removing its effects. In the first place it prevents the effusion of coagulable lymph from the iris, and in the second place it promotes absorption, if there is effusion. No great benefit, however, is derived from it until the mouth becomes sore, and it is astonishing how speedily after this a change takes place in the appearance of the eye. To have the full benefit of it the soreness of the mouth should be kept up for some time. In cases where the constitution is sound and vigorous calomel may be introduced in considerable doses with the view of affecting the gums as speedily as possible. When, on the other hand, the habit is broken down or scrofulous, it must be exhibited in smaller quantities and gradually. In all cases it should be combined with suitable proportions of opium.

Ophthalmia.—Besides iritis there are several other inflammations of the eye in which mercury is a valuable remedy. In the *purulent* or *Egyptian ophthalmia*, in *sclerotitis* (or the rheumatic ophthalmia of Mackensie), and the *catarrho-rheumatic ophthalmia*, the use of calomel and opium carried to the extent of affecting the mouth is attended with the happiest effects.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

Apoplexy.—In this disease mercury as a general rule can be of no further use than as an active and efficient cathartic, and with this view it may be used with great advantage with other cathartics of a more irritating and drastic character. On this subject I have already spoken under the head of cathartics.

Paralysis.—As a cathartic calomel may be used with great advantage in cases of paralysis. By Dr. Colles of Dublin, the use of it has recently been carried much further. By him several interesting cases are related in which a complete cure was effected by producing salivation. The result of these cases would certainly tend to show that it is a remedy of great value.*

Epilepsy.—In this disease mercury has been extensively used and with various results. In some cases it has proved successful, while in others it has failed. Of its beneficial effects when used as a cathartic, there can be no question. In several cases which have fallen under my care, occasional doses of calomel, aided by other active cathartics, have proved of eminent advantage. Of its effects when carried so far as to cause salivation I have no experience in this disease. By some, however, it is spoken of in the highest terms.†

* Practical Observations on the Venereal Disease and the use of Mercury. By Abraham Colles, M.D., p. 197. Am. Ed.

† See Cook on Nervous Diseases, p. 401.

Mania and Hypochondriasis.—As a cathartic, in both these affections there can be no question as to the utility of calomel. In hypochondriasis more especially, associated as that disease frequently is with obstructions of the abdominal viscera, it is particularly beneficial. In some cases, too, carried to the extent of salivation, it has had the happy effect of completely restoring the patient. In these it operates, no doubt, by removing local obstructions, equalizing the circulation as well as the nervous excitement, and probably too as a counter-irritant, by the irritation which it produces in the mouth. By Dr. Rush, it is spoken of in the highest terms. He says, "too much cannot be said in its favor in general madness. I once advised it in a case of this disease from parturition, in which the patient conceived an aversion for the infant that had been the cause of her suffering. On the day she felt the mercury in her mouth, she asked for her infant, and pressed it to her bosom. From that time she rapidly recovered."* By Dr. Burrows, too, several cases are recorded, in which salivation proved curative.† That mercury may, in some cases, prove salutary, is therefore evident. Still it is not to be used indiscriminately, and in nervous and irritable habits, so far from doing good, it may add to the existing irritation.

Dropsy.—There is no class of diseases in which mercury in some shape or other has been more generally used than in the various species of dropsy. The general principle upon which it has been prescribed is, that it promotes the absorption of the effused fluid, and it has accordingly been given indiscriminately to accomplish this object. To any one at all acquainted with the real nature of dropsical affections, it must be evident that this is a very empirical mode of using this potent remedy. Dropsy, as I have already told you, is not so much a disease in itself, as it is the consequence of other diseased conditions of the system. Accordingly, you will find it sometimes resulting from and associated with diseases of the liver; sometimes of the lungs or the heart; sometimes of the brain; sometimes of the kidneys. Generally the result of inflammatory action, it sometimes is a consequence of simple obstruction in the circulation, and sometimes of mere debility.

From this plain statement, it must be evident that so potent a remedy as mercury cannot be applicable in every form of it; and extensive experience has satisfactorily established this fact. In many cases it acts with decided and astonishing efficacy, while in others it proves injurious.

The kinds of dropsical affections in which mercury is most useful are those which are connected with inflammation or some hepatic disorder. Even here, however, the use of it must be confined within certain limits. When the liver becomes indurated, mercury, so far from doing good, does harm, and hastens on a fatal result.

* On the Mind, page 199. † P. 644.

In those cases in which it is connected with diseased kidneys, it has not been found a salutary remedy; in these cases the urine will generally be found coagulable by heat.

There is no form of dropsy in which mercury has been more freely used than in hydrocephalus. With regard to the effect of it, experience differs; while some speak highly of it, by others it is looked upon as a doubtful remedy. Now, with regard to this disease, it is to be recollected that in its primary shape it is an inflammation, while the effusion is a mere consequence of the inflammation. Now mercury, if used in the first stage, in conjunction with bloodletting and other remedies, may prove exceedingly advantageous. As to its efficiency in promoting absorption after effusion has taken place, I must confess that I am somewhat sceptical. With regard to the cases which have been reported as having been cured by calomel, it is to be recollected that symptoms very analogous to those which characterize hydrocephalus may exist without there being any actual effusion. Every now and then we meet with cases of this kind. The inflammation of the brain may terminate in simple distension of its vessels, producing symptoms like those of effusion; then again the same may occur from a congested state of the liver and abdominal viscera; also from exhaustion.

Now, from all these, a child may recover by appropriate treatment; and these are the cases which may be reported as cases of hydrocephalus with effusion.

In the cases depending upon hepatic congestion, calomel may and does prove exceedingly salutary in relieving the secondary symptoms of cerebral oppression.

As a general rule, in using mercury in dropsical affections, there ought to be some vigor of constitution. In old and debilitated subjects, it is a remedy which requires very great caution.

In Chronic Affections of the Viscera, arising from ordinary inflammation as of the liver, lungs, &c., and in congestion of these organs, mercury is frequently of great advantage. But here, too, caution is necessary, and the general state of the system as to vigor and power of enduring irritation must be looked to.

Venereal Disease.—On this I have only a single remark or two to make. By some the use of mercury is opposed on the ground that this disease can be cured without it; and it is true that a vast deal of experience has been brought forward to show that this is the case. Still, I am in favor of the use of mercury. The result of my experience is, that primary symptoms heal readily without mercury, but the system is more liable to secondary symptoms. When this practice was first introduced I tried it, and generally had reason to regret it.

PREPARATIONS OF MERCURY.

1. In the state of Metal.—*Native State.*—This metal is sometimes found in a pure state, when it is called *virgin mercury;* sometimes in the state of protochloride, when it is called *horn mercury;* usually, however, it is in combination with sulphur, forming the *native cinnabar*. It is found in various parts of the world. Its principal localities are the Idria mines in Austria, Almaden in Spain, Mexico, and Peru.

Mode of Extraction.—Almost all the mercury which is used is obtained from the sulphuret. The ordinary mode resorted to for separating the quicksilver is to mix the ore with lime and subject to the action of heat in iron retorts, with receivers attached to them. During this process the sulphur unites with the lime, forming sulphuret of calcium and sulphate of lime; while the quicksilver is distilled over and condensed in the receivers. It is then put into iron flasks, containing sixty or seventy pounds, covered with goat's skin. It is in this state exported.

Properties.—At ordinary temperatures mercury is fluid, of a silver white color, metallic lustre, destitute of smell and taste; its specific gravity is 13·5. It freezes at —39° and becomes solid and malleable. It boils at 656° and is totally dissipated by heat.

Tests of its Purity.—Entirely sublimed by heat,—when a globule is moved along a sheet of paper, it leaves no trail.—*Phar. Edin.*

Impurities and Adulterations.—As generally found in commerce, quicksilver is tolerably pure. Sometimes, however, it contains impurities, and the articles associated with it generally are lead, tin, and bismuth. In this state it loses its metallic brilliancy and has a dull, dirty appearance. It is also less fluid and mobile, and when shaken in a vial soils the glass. The mode of purifying it is to mix it with iron filings, and then distil it in iron retorts.

Physiological Effects.—Taken in its ordinary metallic state, mercury is generally supposed not to exert any action on the human system, and accordingly in the present day it is not used as a medicinal agent. In a state of extremely minute division, metallic mercury is now supposed to have the power of acting on the system. This it certainly does when in the state of vapor, and it is now the prevailing opinion that in the blue pill, blue ointment, and kindred preparations, mercury exists chiefly if not exclusively in the state of extremely minute divisions. See on those

articles. Formerly, metallic mercury was frequently used with a view of obtaining its mechanical effects, in cases of intestinal obstructions. Ounces and even pounds were thus given to force a way through the bowels by means of its specific gravity. In these cases none of the ordinary effects of the mercurial preparations were produced.* In its fluid form mercury produces then, little or no effect, yet it is important to recollect that in the state of vapor it does affect the system, and that it passes into this state at the ordinary temperature of the atmosphere. A striking instance of this occurred in the year 1810, in a couple of English ships which had on board a large quantity of quicksilver. On the voyage some of the flasks burst and the quicksilver was spilled. Shortly after, all the men became salivated and two of them died.†

2. Pilulæ Hydrargyri.—This is known by the common name of the *Blue Pill.* It is prepared by the long trituration of purified quicksilver (℥i) with confection of red roses (ʒiss) and pulverized liquorice root (ʒss).‡ In this way a soft blue mass is formed. For the purpose of ascertaining whether the mercury has undergone the necessary trituration, or as it is usually called is "killed," a small portion of the mass may be rubbed with the end of the finger on a piece of glass or paper. If no globules are perceptible, it is an evidence of its being sufficient. As the manufacture of this pill requires a good deal of time and labor, it is very apt to be imperfectly prepared. At Apothecaries' Hall in London, where the article is made in the greatest perfection, the trituration is effected by means of "a machine impelled by a steam engine, consisting of a circular iron trough for the reception of the materials in which revolve four wooden cylinders, having also a motion on their axis; in this way the admixture of the mercury is perfectly and unexceptionably effected."§ With regard to the precise state in which the mercury exists in the preparation, there is some difference of opinion. By some it is supposed to be simply in a state of minute division, while by others it is thought to be converted into an oxide.

[There is now, I believe, no doubt among the best informed pharmaceutists that the greater part of the mercury in this and the analogous preparations is in a state of mere mechanical division—the only dispute is whether any of it is oxidized. If there is any oxide in the preparation, the proportion is certainly very small.—Ed.]

Three grains of the blue mass contain one of mercury.

Impurities and Adulterations.—The only important impurity to which the blue mass is liable arises from the accidental presence of sulphuric acid

* On this subject see Christison on Poisons, p. 316, Dict. Mat. Med., vol. iv. p. 336.

† Edin. Med. and Phys. Jour., vol. vi. p. 513.

‡ The liquorice root is added to give consistence to the mass.

§ Brande's Manual, p. 500.

in the confection of roses. This acid is sometimes added to heighten the color of the confection, and in this way a sulphate of mercury may be formed during the trituration, and thus the preparation be rendered not merely uncertain but irritating in its effects. (See Paris, p. 439.)

Effects.—This is a mild and exceedingly valuable preparation of mercury. Like the others, its effects differ with the dose. In small doses it gently stimulates the liver and increases the secretion of bile; at the same time it promotes the secretions of the mucous membrane of the digestive organs generally. In this way it produces the effects of a general mercurial alterative. If its use be continued sufficiently long it produces all the constitutional effects of mercury. If given in larger doses it acts as a cathartic.

Dose and Mode of Administration.—The usual form in which it is administered is that of *pill*—or the blue mass may be given diffused through some mucilaginous vehicle. The dose is from 4 to 5 grs. repeated once or twice a day. In doses of 15 or 20 grs. it purges.

3. Hyd. cum Creta.—This is mercury in combination with chalk, and is prepared by triturating three parts of mercury with five parts of prepared chalk until globules are no longer visible. It is in the state of a greyish powder.

Chemical Composition.—8 grs. of this preparation contain 3 grs. of mercury. The state in which the mercury exists here is not settled. According to Mr. Phillips, it is not in the state of protoxide, inasmuch as it is totally insoluble in acetic acid. He is uncertain whether the mercury is merely in a state of minute division with the chalk, or of a suboxide which may be formed during the trituration.* Mr. Brande considers that a small portion of the mercury is converted into the protoxide, while the remainder is simply in a state of minute division.†

Effects.—This is the mildest of all the mercurial preparations—so mild indeed that by many it is supposed not to produce any effect at all. This, however, is a mistake. In its general operation it is the same as the blue pill. The addition of the chalk is supposed to render the preparation milder. From the great mildness of this article it is exceedingly valuable as an alterative for children.

Dose.—From 5 to 20 grs. twice a day. Children, 2 or 3 grs.

4. Unguentum Hydrargyri.—This is the *blue ointment*, and is prepared by rubbing up pure quicksilver with lard until globules are no longer visible. There are two kinds of this ointment used—the strong and the mild—the former contains half its weight in mercury, the latter one sixth. In this preparation mercury exists in the same state in which it does in the

* P. 108. † P. 284.

blue mass and in the hyd. cum creta. It is therefore somewhat doubtful whether it be in the state of oxide or of simple mechanical division. According to the views of Mr. Donovan, it exists partly in a state of simple mixture and partly in the state of oxide, and the medicinal activity of the article is entirely owing to the latter portion.* The strong mercurial ointment alone is used in New York.

Effects.—Rubbed on the surface it produces all the constitutional effects of mercury. If you wish to salivate speedily half a drachm may be rubbed in the skin every hour, marking the effect each time and varying the seat of application. If you do not wish to excite salivation so speedily ℨss or ℨi every night and morning will answer. The part best suited for the application is where the cuticle is the thinnest—the inside of the thigh, and it is best to do it before a fire to liquify the ointment and promote absorption. The occasional use of the warm bath promotes its operation; where a second person has to perform the friction, the best mode is to cover the hand with a pig's bladder, turned inside out.

Oxides of Mercury.—(*a*) *Protoxide.*—This, in pharmaceutical language, is known by the name of the *Oxydum Hydrargyri Cinereum*, and by the common names of the *black*, *grey*, *or ash colored oxide.*

Properties.—It is a dark colored powder, varying in its shades, sometimes black, at others grey, or ash-colored. It is destitute both of taste and smell. In water it is insoluble.

Chemical Composition.—As found in the shops, it varies considerably it its composition, and to this is owing the difference in color. The principal ingredient is the *protoxide.* Besides this, however, it contains frequently *calomel*, *peroxide*, and *metallic mercury.* The first of these—calomel, arises from the imperfect decomposition of that salt in the original preparation. A portion of the calomel remains undecomposed, and this mixing with the protoxide gives it the peculiar grey color. The other ingredients arise from the action of light upon the black oxide. On exposure to light, a portion of it loses its oxygen, and is reduced to the *metallic state*, while the same oxygen goes to another portion and forms the *peroxide.* The combination of peroxide with the black oxide gives the whole an olive color.

Physiological Effects.—This is a mild preparation of mercury, producing the general effects of the drug on the system. A great objection to it is the variable nature of its composition.

Dose.—From one to three or four grains, twice a day. It is very little used.

Red Precipitate.—*Hydrargyri nitrico-oxidum.*—This is prepared by taking *purified mercury*, *nitric acid*, and *distilled water*, and boiling them

* Paris, p. 509. Mr. Brande thinks it is chiefly in the state of protoxide, p. 518.

in a glass vessel until the mercury is dissolved. Then evaporate the water, when a white mass will be left. Rub this into powder, and put it into a shallow vessel, then apply a gentle heat and gradually increase it until red vapors cease to arise.

Properties.—When properly prepared, this is of a bright red color, and shining scaly appearance. It is without smell, but has an acid metallic taste. When pure it is perfectly insoluble, but as it generally contains a little nitrate of mercury, it is slightly soluble in water; at a red heat it is decomposed; oxygen is given off, and metallic mercury produced and vaporized.

Effects.—From the great activity of this article it is not used internally. When accidentally taken, it proves irritant and poisonous. It is only used as a local application. In its pure state it acts as an escharotic, and in the form of powder is applied to chancres, indolent ulcers, &c. The more common form is that of ointment. Red ox. ℥j. ung. simp. ℥vij. M. intime. This may be diluted if too strong, with lard. If kept it turns black, owing to the peroxide changing to protoxide—good stimulating ointment to change the character of ulcers.

Unguentum Nitratis Hydrargyri.—Commonly known by the name of *Citrin Ointment.* Prepared by dissolving mercury in nitric acid, and then adding a certain proportion of lard and oil while the solution is hot. Here the metal is first oxidized by a decomposition of part of the nitric acid, and then combined with the remainder making a nitrate of mercury. The salt first formed is a pernitrate; by the action of the fat and oil it is partially decomposed and reduced to a protonitrate.

Properties.—Where recently prepared of a beautiful yellow color, and of the consistency of butter. By keeping it acquires a dirty greenish color, and becomes hard and friable; neatsfoot oil preserves its properties. Hence, in the U. S. made with a proportion of this.—U. S. Disp.

Effects.—A stimulant and alterative application, and used in a great number of local affections. In chronic diseases of the skin, ophthalmia tarsi. To be diluted according to the effect desired.

6. CHLORIDES.—Of these there are two—the *perchloride* and the *protochloride.*

Perchloride of Mercury.—This is *corrosive sublimate.*

Preparation.—Corrosive sublimate is prepared by boiling purified mercury with sulphuric acid, until it becomes dry. This is then triturated with muriate of soda (chloride of sodium), and sublimed by a strong heat. The object of the first part of this process is to form a persulphate of mercury; in the second part, the sodium is converted into soda, by the oxygen of the peroxide of mercury. This then unites with the sulphuric acid, and forms sulphate of soda, which remains at the bottom of the vessel. In the meantime, the chlorine unites with the mercury, and forms the bi-chloride of mercury, which is sublimed.

Properties.—Thus obtained, corrosive sublimate is a semi-transparent crystalline mass; its specific weight is 5·2. It is destitute of smell, and has an acrid and nauseous taste. It dissolves in twenty parts of cold water and about three times its weight of boiling water. In alcohol, it is much more soluble; although light has no action on the salt itself, yet an aqueous solution of it is decomposed by exposure to it. The proto-chloride of mercury is precipitated, and muriatic acid is formed in the solution (Phillips). Totally volatilized by heat.

Chemical Composition.—Corrosive sublimate consists of two proportionals of chlorine $36 \times 2 = 72$, and one proportional of mercury $200 = 272$. Phillips.

Effects.—These vary with the dose and mode in which it is used. In small doses, it produces no immediate or manifest effects on the system. If continued, however, a considerable length of time, it developes all the ordinary effects of mercurials, in the way of excitement and salivation. If the dose be somewhat increased, it acts as a local irritant, causing griping and purging. As a general rule, it does not so speedily produce salivation as the other preparations of mercury. Externally applied, it is stimulant and escharotic. In *large* doses, it acts as a virulent and corrosive poison.

Mode of Administration.—1. *Pill.* This is the ordinary form and a very good one. It may be rubbed up with an equal portion of muriate of ammonia, and made into a mass with crumbs of bread. Each pill may contain $\frac{1}{16}$ or $\frac{1}{8}$ of a grain to be taken twice a day.

2. *Solution.*—Dissolved in water or alcohol, it is also given internally in the same quantity.

3. As a local application, it is used in two forms: 1. In the state of simple solution, about grs. ij of the sublimate being dissolved in ℥ viij of water, and sweetened with honey. In this way it is used as a local application to remove ulcers in the throat.

2. *The Yellow Wash.*—This is prepared by adding lime water to corrosive sublimate in the proportion of grs. i to iij to the ounce. Here a hydrated peroxide of mercury is thrown down, and the chloride of calcium is in solution. It is therefore a solution of the chloride of calcium mixed with peroxide of mercury. This was formerly called the aqua phagedenica, and is much used as a local application to venereal and phagedenic ulcers.

7. Calomel.—This is the proto-chloride of mercury, commonly known under its old chemical name of the sub-muriate, also the mild muriate of mercury.

Modes of Preparation.—These vary. I shall give that of our own pharmacopœia. Take of mercury four pounds, sulphuric acid three pounds, chloride of sodium a pound and a half, distilled water a sufficient

quantity; boil two pounds of the mercury with the acid, until the sulphate of mercury is left dry; rub this when cold with the remainder of the mercury in an earthenware mortar till they are thoroughly mixed, then add the chloride of sodium, and rub it with the other ingredients till all the globules disappear; afterwards sublime. Reduce the sublimed matter to a very fine powder, and wash it frequently with boiling distilled water, till the washings afford no precipitate upon the addition of solution of ammonia, then dry it.

Tests of its Purity.—Entirely dispersed by heat. Sulphuric ether agitated with it, and then filtered and evaporated leaves no crystalline residuum, and what residuum may be left is not turned yellow by aqua potassæ.—*Phar. Ed.*

Physiological and Therapeutical Effects.—Upon these I will not dwell; having in my general remarks on mercury usually referred to calomel as the particular mercurial by which the best effects of the metal can be secured, all that I could now say would be but a repetition of what has gone before. A few words on some of its more useful combinations and its local application is all that seems necessary. Combined with Dover's powder, calomel is one of our most reliable diaphoretics. Equal parts are commonly given; the proportions may, of course, vary according to circumstances.

Calomel and squills, one grain each in pill, has few equals as a diuretic; it should be pushed to a gentle salivation, unless free diuresis occur before. Combined with the golden sulphuret of antimony and gum guaiac (Plummer's pill), calomel is much used as an alterative in chronic diseases of the skin.

Local Use.—Calomel is used locally, either alone or in the form of black wash. Powdered calomel blown into the eye is an approved remedy in opacities of the cornea. Rubbed up with lard it is applied to ulcers as a mild stimulant. The black wash, made by adding calomel ℈i to lime water ℥viij, is an excellent application to irritable sores, excoriations, &c. &c. It is used very generally in gonorrhœa.

Dose.—When given as an alterative, half a grain to one grain twice a day; to produce salivation, two, three, or five grs. three times a day; as a purgative, grs. x to grs. xx.

[It has been of late proposed to give calomel in very minute doses, $\frac{1}{12}$ to $\frac{1}{24}$ grain every hour to produce rapid salivation. It is said to have touched the gums in twenty-four hours.—Ed.]

DIAPHORETICS.

The term Diaphoretic is applied to that class of medicinal agents which possesses the power of increasing the natural exhalation from the skin. When this is carried to the extent of producing actual sweating, they are sometimes denominated *Sudorifics*. The terms, however, are generally used indiscriminately—and in reality the distinction is a matter of no great consequence, as the difference between them is only in the degree of effect produced. What shows this conclusively is that, if what are strictly called diaphoretics be given in increased doses, a sudorific effect may be produced, and vice versa. In the case of diaphoresis, the discharge from the skin passes off in the form of insensible vapor, while in the case of sweating it is in the state of a fluid. The class of agents, therefore, of which we are now to treat are those which increase the discharge from the skin, whether this be in the form of vapor or fluid.

The modes in which a diaphoretic or sudorific effect may be produced are various. In some cases, it is produced by agents which have a tendency to relax and debilitate the system; in others again, by those agents which stimulate. Sometimes, it is produced by agents taken internally; while in others, by those acting directly upon the skin.

Effects of Diaphoretics.—Acting on a surface so extensive as the skin, and producing frequently very copious evacuations from it, it is evident that diaphoretics must cause very important changes in the system. Among these, the following are the most striking:—

1. *They change the state of the Circulation.* From the increased determination of blood which takes place to the surface during the process of perspiration, it is manifest that the quantity of that fluid in other parts of the system must be diminished. Hence it is that in cases of internal congestions, as soon as free perspiration is brought about, relief is obtained. In this way, a more equal and uniform distribution of the circulating fluid is produced. With regard to the action of the heart and arteries, the effect of sudorifics must necessarily differ, according to the character of the article used. If it be stimulating, the heart's action will be increased, and the pulse will become fuller and more frequent, and vice versa. The effect of mere sweating, however, upon the vascular system is to diminish action. Hence, under the operation of sudorifics which are not stimulating, the

pulse becomes slower and softer; and, if the sweating be carried too far, it becomes weak, tremulous, and frequent.

With regard to the effects of sweating on the *blood* itself, it is evident that it must diminish the quantity of that fluid. It might naturally be supposed too that it would have a tendency to render the blood thicker by draining off the thinner or serous part. This, however, is not found to be the case, doubtless because the loss is promptly supplied by the absorption of watery fluids by the blood-vessels.

2. *Sudorifics produce a change in the condition of the Skin.*—Under their influence not merely an increased flow of blood takes place to the surface, but the condition of the exhaling vessels is changed according to the previous condition of the skin and the kind of sudorific agent which is used. Thus, if there be a great degree of general excitement present and the skin be hot and dry, the effect of debilitating sudorifics will be to cause diminished action and relaxation of the cutaneous vessels. If on the other hand the skin be cold, dry, and torpid, and stimulating sudorifics be administered, there will be increase of action in the cutaneous vessels. Besides this mere increase and diminution of action, there is every reason to believe that under the use of certain agents, a new action is set up in the capillaries of the surface producing an alterative effect.

3. *Sudorifics produce a change in the Temperature of the Body.*—The necessary effect of sweating is to lessen the degree of animal heat, and the extent to which this is carried is of course proportioned to the duration of the process and the quantity of fluid which is lost. The effect thus produced is obvious to the senses and may be easily appreciated by a proper thermometer. Thus, if the natural heat at the commencement of perspiration be at 108° or 110°, after this process has continued for six or seven hours, the thermometer will hardly be raised to blood heat.

4. *Sudorifics produce a change in the conditions of various portions of the Mucous Membrane.*—During the operation of sudorifics the flow of blood is diverted from the mucous tissue, and the secretions from it are generally diminished. Thus in the mouth and fauces dryness and thirst are produced. The most striking illustration of this, however, is noticed in the intestines. Between these and the skin there is a wonderful sympathy. Thus, if perspiration be suddenly checked, diarrhœa frequently occurs. So also during the operation of an ordinary cathartic, the skin becomes cool, dry, and torpid. On the other hand free perspiration interferes with the due operation of a cathartic and checks the determination to the bowels. The same holds good in relation to the mucous membrane of the lungs. Hence it is that a warm climate and all those agents which act on the skin are so beneficial in certain affections of this membrane.

5. *Sudorifics produce a change in the condition of the Urinary Organs.*—The sympathy between the skin and kidneys is perhaps still more striking than that between the skin and bowels. Whenever, therefore, the

perspiration is increased the urine is diminished in quantity and vice versa. In the healthy condition of the system this fact is continually illustrated under the ordinary changes of the atmosphere. In winter, when the perspiration is less, the quantity of urine is always greater than in summer. Under the use of diaphoretics the urinary secretion is always lessened.

6. *Sudorifics produce a general debilitating effect on the System.*—During the free operation of sudorifics the nervous energy and muscular strength are both impaired, and just in proportion to the extent of the sweating. The debility thus induced is frequently much greater and more felt by the constitution than a large bleeding (Alexander, p. 174). This need excite no surprise when we reflect upon the extensive depletion which the system may undergo during this process if continued for any length of time. Of this some idea may be formed if we recollect how much is lost under ordinary circumstances in a state of health. From the experiments of Lavoisier and Seguin it appears that the average of insensible perspiration amounts to about eighteen grains in the minute, or three pounds, three ounces, and one hundred and sixty grains troy in twenty-four hours. (Thomson, vol. ii. p. 473.)

CIRCUMSTANCES MODIFYING THESE EFFECTS.

1. *Age.*—From the progressive changes which the skin undergoes from infancy to old age, it is evident that its functions will also vary, and, of course, that the effects of medicinal agents upon it will be greatly modified. In a state of health, as a general rule, children sweat less than adults, and in them it is much more difficult to excite perspiration in cases of disease. This is probably owing to the great rapidity of the circulation in early life. In *old age* the cutaneous secretion is also less than in middle age. The capillaries of the surface become torpid and inactive.

2. *Climate.*—The effect of climate on the skin is peculiar and striking. In cold regions the skin becomes dry, hard, and thick—losing the pliability and delicacy of touch which characterizes it in temperate and warm latitudes. As a matter of course, agents designed to excite the functions of the skin cannot be so effective. It will, accordingly, be found that diaphoretics do not produce the same effects in cold regions that they do in warmer ones. Sir George Balinghall remarks, that in the East Indies much smaller doses of sudorifics produced the desired effect than were necessary in a colder climate. In this way too, perhaps, may be explained the great success attending the use of various stimulating sudorifics, such as Guaiac, Mezereon, &c., curing the venereal disease in the West Indies, which they have failed to do in other regions.

CONDITION OF THE SYSTEM NECESSARY TO PRODUCE THE EFFECTS OF DIAPHORETICS.

Unlike many other medicinal agents the effects of diaphoretics cannot be secured under every condition of the system. Emetics and cathartics may be made to produce their effects as a general rule under almost any circumstances. Not so diaphoretics. Unless the system be in a state favorable to their action, little or no effect is produced. Hence it is that they have been looked upon as remedies very uncertain in their character, and by many have been in a great measure rejected. This is, however, altogether an erroneous view of the subject. That diaphoretics are uncertain, if indiscriminately used, is very true. If, on the other hand, they be used with due regard to certain conditions of the system they are by no means uncertain, and they become remedial agents of great power. Under these circumstances, it is essential to ascertain and fix, if possible, the precise state of the animal economy most favorable to their operation. As the result of observation and experiment, it has been established that to secure the favorable and efficient action of sudorifics, there are two things which require specially to be attended to; and these are, the *degree of animal heat* and the *state of circulation.*

From a series of well conducted experiments made long since by Dr. Alexander, of Edinburgh, the fact was established that a certain degree of heat, which he calls the "sweating point," is absolutely necessary to produce sweating; and the further the heat of any person is advanced above, or reduced below, this standard, the further is he removed from any possibility of sweating.* Although it is reasonable to suppose that this standard of heat must differ somewhat in different individuals, yet Dr. Alexander states, as the result of his trials, that it is commonly six, eight, or ten degrees above what is natural to the constitution in perfect health.†

By others the degree of heat favorable to perspiration is placed somewhat lower. Dr. Dewees puts it only two or four degrees above the natural standard, which is 98°.‡ Perhaps from four to six degrees is nearer the truth than either. Now just in proportion as the heat of the system is raised above or reduced below this point will be the difficulty of producing perspiration.

Besides a certain degree of heat, a certain condition of the vascular system is also necessary to insure the operation of diaphoretics. If the pulse be hard, strong, and frequent, as it is in febrile and inflammatory complaints, all attempts at producing sweat will be unavailing. On the other hand, when the pulse is oppressed and the circulation slower than

* Experimental Essays. By Wm. Alexander, M.D. London: 1770. P. 165.
† Ibid, p. 205. ‡ Practice, v. i. p. 78.

natural, as it is in certain congested states of the system, the same difficulty will occur.

RULES TO BE OBSERVED IN THEIR APPLICATION.

1. To secure the operation of diaphoretics the first thing to be done is properly to regulate the circulation and the degree of animal heat, so as to bring the system within the range favorable to the process of perspiration. If the pulse be full, hard, and frequent, this should be corrected by venesection, cathartics, &c., according to the particular circumstances indicated by the case.

2. The heat of the body should be carefully regulated. Wherever the degree of heat is above 102° or 104°, it should be reduced by appropriate means. For this purpose venesection and evacuants may, in some cases, be necessary. Where these are not required, the free use of *cold water* will answer every purpose. So decidedly does this operate in lowering the temperature, that it frequently brings on sweating without any other means.* On the other hand, where the degree of heat is too low warm drinks will be required to raise it.†

2. During the use of diaphoretics, especial attention should be paid to the state of the bowels. If purging or diarrhœa is present, it frequently happens that everything given to produce diaphoresis only increases the intestinal discharges. In these cases opium may be resorted to with the double advantage of checking the diarrhœa and determining to the surface.

3. The condition of the kidneys should also be particularly attended to. For this purpose every article of drink or medicine which acts upon the urinary organs should, as much as possible, be avoided. If it be found, as is sometimes the case, when giving diluents and other articles to promote perspiration, that a determination of fluids is taking place to the kidneys, the best plan is to desist from the use of internal remedies and to trust to external applications to accomplish their object, or to rely on opiate diaphoretics.

4. During the use of diaphoretics the patient should be kept in bed, and both the body and bed covering should be of flannel. This is a bad conductor of heat and keeps up a uniform temperature around the body, at the same time that it absorbs moisture.

5. To gain the full effect of this class of remedies, their use must be accompanied by plentiful dilution. Unless this is done, the effect on the skin is soon suspended. With regard to the kind of diluent to be used, that must be determined by the state of the system. If the temperature

* Alexander, p. 163. † Alexander, p. 205.

be above the "sweating point," then cold drinks are proper; if, on the other hand, it is below that standard, they are to be used warm.

Diaphoretics, like soporifics, generally operate better if given about the usual time of going to sleep, *horâ somni.* At this time there is generally such a tendency to relaxation and to sweating, that diaphoretics will operate with more power and more certainty.

When perspiration is to be arrested, it is not to be done by the use of cold drinks or by the application of cold to the surface, but by rubbing the patient dry and gradually removing his covering.

MODES IN WHICH DIAPHORETICS PROVE CURATIVE.

1. By changing the distribution of the blood. In this way they equalize the circulation and relieve determination to the internal parts of the system.

2. By depleting the system. In this way they lessen the action of the heart and blood-vessels, and diminish morbid excitement.

3. By changing the condition of the skin. When it is morbidly hot, dry, and constricted, relaxing it and lessening the temperature of the body.

4. By directly lowering the degree of animal heat.

By some eminent authors the direct curative power of diaphoretics is altogether denied. Dr. Holland* states that the improvement that often follows their use depends not on their direct influence on exhalation, but on other changes which they produce on the system, and of course that diaphoresis no further important than as proving the action of the remedy on the system. [This opinion is common among our best practitioners. —Ed.]

PRACTICAL APPLICATIONS.

I come now to make some very brief remarks on the use of sudorifics in the treatment of diseases.

1. *Fevers.*—As you probably know, there is no class of remedies which has been so generally popular in these diseases as sudorifics. This has arisen very naturally from the fact so constantly observed, that sweating is the process by which fevers, when left to themselves, usually come to a crisis. You see this very strikingly illustrated in ordinary intermittent fevers.

Accordingly, in all ages, and amid every variety of doctrine and theory in relation to febrile affections, remedies acting on the skin have been

* Med. Notes and Reflections, p. 52.

resorted to, and there can be no question of their general utility and efficacy. Like all others, they may, and have been much abused, or at any rate may fail of producing their full effect. To enable you to use them advantageously, the following circumstances should be attended to.

1. *The Stage of the Fever.*—From what has been already said of the operation and effects of diaphoretics in general, it is very evident that the first stage of fever is unfavorable to their exhibition. The large viscera are in a state of congestion, and animal temperature is usually below the point favorable to perspiration. To excite perspiration under such circumstances is exceedingly difficult, unless it be done by such means as have a most injurious effect upon the system, i. e. by agents of a heating and stimulating character. Among the older physicians this was the ordinary practice, and all sorts of stimulants and alexipharmics (as they were called) were freely prescribed.

This practice, however, has entirely gone out of date. The stimulating diaphoretics are very rarely given in the first (cold) stage of fever. There is one class of these remedies which may very often be given even in this stage—I mean warm teas, their operation being aided and their action directed to the skin by warm covering.

It is in the second stage of fever that diaphoretics may be used with the best prospect of advantage; but to secure this, attention must be most particularly directed to the state of the system in each particular case, and should the patient be very plethoric, the pulse full and strong, and the animal heat above the sweating point, you will in vain attempt to bring on diaphoresis. In all these cases, therefore, the system must be brought into a proper state by appropriate means, and when this has been done, it is frequently surprising how readily the skin, before obstinately dry and constricted, will become soft and moist. Besides attending to the circulation and the temperature of the body, there is another point of very great practical importance, and that is the condition of the abdominal viscera. In all cases these should be thoroughly unloaded and their secretions properly regulated, before the full and beneficial effects of sudorifics can be obtained.

In the use of the remedies to accomplish this effect, everything must be decided by the particular circumstances of the individual case. If there be great vigor of the system and an active circulation, those should be selected which are the most debilitating in their operation, and of these tartar emetic takes the lead. It is a great excellence of this article, that by modifying the dose it may be made to accomplish almost any degree of effect which may be desired. In using it, therefore, in fever, especial regard must be had to this fact. In some cases the $\frac{1}{16}$ of a grain will be sufficient, while in others it may be pushed as far as $\frac{1}{8}$ or $\frac{1}{4}$ of a grain, repeated every two or three hours. In other cases, where there is less vascular action, and the powers of the system more reduced, this article would be wholly

improper. Here the antimonial powder or the spiritus mindereri answer a much better purpose, or if prostration be very considerable, infusion of snake root (*Serpentaria virginiana*), and wine whey are the best sudorifics.

With regard to the use of opium in fever as a sudorific, I can only advise you to be cautions. Its ordinary effect, as you know, is to restrain all the secretions of the system except those of the skin, and as your general object in fever is to keep all excreting and secreting apparatus open, it may prove exceedingly injurious. The best form is that of Dover's powder. Even this, however, is to be used with caution, and only where the previous evacuation has been free, vascular action feeble, and the head unaffected.

2. *Inflammations.*—In all inflammatory affections determination towards the skin has a salutary effect. It equalizes the circulation—diverts the current of fluids from the inflamed organ—lessens general vascular excitement. To produce such a salutary determination in inflammation is, however, by no means an easy task, and must be brought about by properly preparing the system at first by appropriate venesection, purging, and the like, and then by the judicious selection of appropriate sudorific agents. As a matter of course all heating and stimulating articles are to be avoided and such only used as have the effect of repressing excitement. As a general rule the agent which can be most safely trusted in these cases is tartar emetic. As already stated, perspiration can only take place when the heat of the body as well as the vascular excitement is brought within certain limits. Now when this has been accomplished by venesection and other evacuant remedies, tartar emetic in repeated doses has an admirable effect in keeping down the excitement permanently and thus preserving the system in the state appropriate to cutaneous determination. In this way this remedy acts in a double capacity as a sudorific. In other cases where the excitement has been properly subdued milder articles may answer every purpose. [Especially may we rely on ipecac as on the one hand safe in cases attended with considerable excitement, and on the other not likely to produce the mischievous effects which tartar emetic, even when carefully watched, will every now and then cause. The proportion of cases of inflammation in which ipecacuanha can be wisely substituted for tartar emetic is pretty sure to increase upon us as we grow old. The young doctor despises ipecacuanha and admires tartar emetic. The old doctor fears tartar emetic and trusts ipecacuanha.—Ed.]

3. *Diseases of the Lungs.*—There is no class of affections perhaps in which the agency of those remedies which keep up a determination to the skin is more marked or decided than certain affections of the chest, more especially those of a chronic character. Among these, ordinary pulmonary consumption will serve as a striking illustration. The whole history of this disease from its commencement to its termination shows how closely it is connected throughout its various stages with the condition of the skin.—

Many of the causes concerned in its promotion are those which act directly on the skin, such as climate, dress, exposure to cold, &c., checking cutaneous action and secretion, and causing preternatural determinations to the lungs. During its progress, too, the skin is always in an unnatural state—at one time dry, cool, and torpid—then morbidly hot or profusely perspiring; all this would seem to show the intimate connexion between the state of the skin and that of the lungs. Experience too has shown that the agents which have proved most efficacious are those acting either directly or indirectly on the surface. Among those most worthy of mention are a warm climate, exercise, sea voyage, tepid bath, and the internal use of tart. antimony. This latter remedy especially is one of great efficacy if used with due precaution. If commenced in due season and in small doses it controls the circulation and keeps a constant and most salutary determination to the skin, and in this way proves most effectual in relieving pulmonary determination. By the use of it for a length of time with proper diet, regimen, and exercise, more may be done in warding off pulmonary consumption than perhaps by any other mode of treatment.

Dysentery.—This is a disease in which sudorifics have been much lauded and certainly with no little justice. The functions of the skin are impaired while a great determination of fluid takes place towards the liver and intestines. By causing a derivation to the skin this abdominal congestion is relieved, and if accompanied with other appropriate treatment it may prove most efficacious in eventually breaking up the disease. From the great distress and intestinal irritation present in this disease, the best article which can be selected is the Dover's powder. This quiets pain and irritation, and at the same time determines powerfully to the skin. As a general remedy in this complaint there is none which is so efficacious. It may be used either alone, which is better in many cases, and in combination with calomel. By this combination you have the advantages of two of the best remedies that I know of.

INDIVIDUAL DIAPHORETICS—(EXTERNAL).

1. *Friction.*—Although not of itself capable of producing perspiration, it is an admirable preliminary in many cases to the use of other agents. It awakens the sensibility of the skin, causes a new determination of blood to that surface, and in torpid states of it coöperates most advantageously and powerfully in exciting cutaneous exhalation. In the Turkish baths the use and effect of friction are strikingly illustrated.

2. *Water applied to the surface.*—This may be done in various ways—by *affusion*, by the general *bath*, by the *vapor bath*, and by *local applications* of it.

Water may be applied of various temperatures. By *cold* water we

mean water of a temperature ranging from 40° to 60°. By *tepid* from 85° to 92°. By *warm* from 92° to 98°. By *hot* from 98° to 112°.

By *affusion* we mean pouring water over the naked body of the patient. For this purpose he is stripped naked and seated in a tub and a bucket of water poured over him. If necessary it may be repeated three or four times; after this he is to be put to bed.

Now the affusion may be either *cold* or *tepid*. When the system is laboring under febrile excitement, and the agent is properly applied, the effects of the *cold affusion* are the following:—reduction of the temperature of the body, diminution in the force and frequency of the pulse, frequently of from eight to twenty pulsations in a minute, relaxation of the skin and mucous surfaces, and finally sleep. To produce these effects, however, the agent must be properly used.

As this remedy appears to act as a direct sedative, lessening animal heat and impairing the action of the pulse, it is requisite in using it that the degree of heat and excitement should be above the natural standard. If this be not the case, so far from acting in the way just mentioned, it will produce effects entirely different. Instead of reducing heat and excitement to a healthy standard and causing salutary perspiration, it will unnaturally subdue the actions of the system and reduce the powers of life.

2. It should never be used when perspiration is actually going on. During perspiration, animal heat is rapidly diminishing. To apply cold water under these circumstances might increase the abstraction of heat to so great a degree as to endanger the safety of the patient. Besides this, the sudden check given to perspiration would inevitably produce dangerous determinations to particular organs at a time when the system is not in a fit condition to reach and relieve these determinations.

Wherever local inflammation exists, the cold affusion is improper. It necessarily augments the local difficulty without lessening the accompanying excitements.

Sometimes the *tepid* affusion is used. In this the water is still colder than the ordinary temperature of the body, and therefore its effect in abstracting heat must be the same as the cold affusion, differing only in degree. Its general operation therefore is the same. It lessens heat—diminishes the frequency of the pulse—relaxes the skin—promotes perspiration, and creates a disposition to sleep. Indeed, it sometimes appears to lessen animal heat more rapidly than the cold effusion, inasmuch as it causes more evaporation from the surface. Besides this, the tepid affusion does not cause such sudden determinations internally, nor any of the reaction which is produced by the cold affusion. On this account it may be safely used in many cases in which the application of cold would be injurious, as in inflammation, &c.

Besides the affusion, water is also applied in the form of *baths*; as diaphoretics we use the *tepid*, *warm*, and *hot baths*.

The *tepid bath* ranges from 85° to 92°, and although the temperature is lower than that of the body, yet it feels warm, because the surrounding atmosphere is generally below this point and accordingly the body is parting with more caloric. It operates very much like the tepid affusion—promotes the flow of blood to the surface, quiets irritation, produces a soothing influence over the whole system, relaxes the skin, and promotes perspiration.

The *warm bath* ranges from 92° to 98°. The effect of this is somewhat different. At first it renders the pulse fuller and more frequent, quickens respiration, and promotes perspiration; speedily it leaves the system languid, with loss of muscular power, faintness, and disposition to sleep. It is more stimulating at first than the tepid bath.

The *hot bath* ranges from 98° to 112°. It exceeds the heat of the body. In its effects this is directly and powerfully stimulating in proportion to the degree of heat. The rapidity and force of the circulation is increased —the breathing becomes difficult—head congested—the surface becomes red, and the vessels of the skin distended. In the course of half an hour or so perspiration comes on. The hot bath is used principally in chronic affections, such as rheumatism, paralysis, &c. Its effects should be carefully watched or it may do very great mischief.

Hot Water locally applied.—One of the most efficient modes is a large piece of flannel wrung out of boiling water and wrapped round the legs and thighs. This excites perspiration very speedily and certainly even when other more complicated means fail. In five or six minutes after the application perspiration frequently breaks out. Another advantage attending this mode is that it does so with less increase of heat than many others. In an experiment made by Alexander, his pulse which stood at 72° only rose to 77°, and the thermometer at the pit of the stomach, which stood at blood heat, only rose two degrees. After perspiration had continued half an hour, his pulse fell to 74°, and shortly after to 70°, and the mercury had fallen one degree.

Vapor Bath.—The simplest mode of applying the vapor bath is to fasten a blanket round the patient's neck after he is stripped, so as to envelope the whole body. He then sits down on a low stool and the blanket is closed around him by means of pins. Under the blanket is to be introduced a vessel containing some simple herbs and upon which boiling water has been poured. In a very short time the warm vapor exuding from this is felt by the patient—the temperature is increased and free perspiration soon comes on. If it be requisite to increase or keep up the heat, hot bricks may be thrown into the water at suitable intervals. The vapor bath is more powerfully derivative than the warm water bath and consequently more certainly diaphoretic, but at the same time less soothing and tranquillizing [and very much more certain, when

it does no good to do much harm. Its immediate effects should be closely watched.—Ed.]

3. *Air.*—Heated air applied to the surface is another one of the most powerful modes of exciting perspiration. The effect of warm climates and seasons in causing perspiration is so very obvious and striking that it is singular that no greater use has been made of the artificial application of hot air. It was not, however, until recently that it was even thought of. In 1819 Dr. Gower contrived what he called a *sudatorium* for this purpose. This consisted of an oblong wicker arch, which was placed over the patient and covered with blankets. "At the end of this frame and under the covering, was placed a lamp, over which rose a kind of chimney or tube, which conveyed the air heated by the lamp to the space surrounding the patient." At the temperature of 85° air applied in this way stimulates powerfully the surface and causes profuse perspiration. In this way it is more certain in its effects than either the warm bath or vapor bath. From its stimulating character it is peculiarly adapted to those cases in which the skin is cold and torpid, and where the balance of the circulation is greatly disturbed by internal congestions.

INDIVIDUAL DIAPHORETICS—(INTERNAL).

1. Antimonials:—
   Tartar emetic,
   James's powder,
   Pulvis antimonialis,
   Sulphuret of Antimony.
2. Solution of Acetate of Ammonia.
3. Neutral mixture.
4. Effervescing draught.
5. Opium.
6. Ipecacuanha.
   Dover's powder.
7. Nitre.
8. Eupatorium perfoliatum.
9. Asclepias tuberosa.
10. Cold and tepid drinks.

(EXTERNAL.)

Cold affusion, Tepid affusion, Steam, &c.

Antimonial Diaphoretics. *Pulvis Antimonialis vel Pulvis Jacobi, the Antimonial Powders* or *James's Powders.*—This combination of the oxide of antimony and the phosphate of lime had at one time great popularity as a diaphoretic in fever. It is now rarely used, and might with advantage be banished from the Pharmacopœia. The objections to it are that it is very uncertain in its operation, because very variable in its composition.

Tartar Emetic.—Of this I have spoken under the head of Emetics

and in the general observations I made on Diaphoretics. It is much used and often with the best effects. From the general relaxing and depressing power of the remedy, it is evident that it is appropriate to cases where the tone of the system is above par—in such it will often do good.

Objections :—1st. It sometimes irritates the bowels and causes a troublesome purging. 2d. The degree of its prostrating power can never be known beforehand. It must, therefore, always be watched closely. Dose, one eighth grain, either in solution, or combined, as proposed by Dr. Brande, with chalk, in his substitute for James's Powders :—

Ant. Tart. gr. viij.
Pulv. Gum arabic,
Creta ppt. āā ʒj.—M.

Sixteen grains of this powder contain one grain of tartar emetic. Dose—one to two grains.

Aqua Acetatis Ammoniæ vel Liquor Acetatis Ammoniæ.—This is commonly known under the name of the *Spiritus Mindereri*, Mindererus' Spirit, under the notion that he first prepared it. This is a mistake: it was first made, in 1732, by the celebrated Boerhaave. It is prepared by adding carbonate of ammonia, in powder, to distilled vinegar, and stirring until effervescence ceases. In this process the acetic acid unites with the ammonia, while the carbonic acid escapes. This preparation, therefore, consists of acetate of ammonia held in solution by water. From the variable strength of distilled vinegar, it is impossible to fix upon any definite quantity of the carbonate ammonia which may be necessary to saturate the acetic acid. The best mode of ascertaining it is by testing the solution, during its preparation, by the alternate use of turmeric and litmus paper. If perfectly neutral, neither of these will be affected. The rule, however, laid down, is to let the acid appear to be slightly in excess, "for the carbonic acid, which remains for some time in solution, and which seems to indicate excess of acetic acid, is eventually dissipated by time;"* in which case, the solution becomes alkaline and somewhat irritant. This is especially important in cases where this preparation is used as a collyrium. It is obviated by a slight excess of acid.

Properties.—When pure, this preparation is limpid and colorless: any color, therefore, which it may possess is owing to impurities either in the ammonia or the vinegar.† As commonly prepared, it is of a brownish color. By filtering, however, "through a little well burned and recently powdered charcoal" it becomes perfectly colorless.‡ It is without smell, and has a slightly nauseous taste. "It should not be prepared in large quantities, as its acid becomes decomposed, and a portion of carbonate of ammonia is generated."§

* Phillips, p. 43.
† Pereira, v. i. p. 183.
‡ Brande, p. 217.
§ U. S. Disp. p. 756.

According to Rennie, if either the acid or alkali is in excess, it will decompose the antimonials, with which it is frequently prescribed.*

Effects.—This is a most excellent diaphoretic, although spoken of slightingly by some, and not very generally resorted to in the practice of the present day. It acts on the skin without producing any marked effect on the circulation, either in the way of exciting or depressing it. Its action on the stomach is that of a mild stimulant. It accordingly sits well upon that organ, and frequently answers an excellent purpose in cases where a sudorific is required. Unless its operation be aided by tepid drinks, and by keeping the surface covered, instead of acting on the skin, it is apt to run off by the kidneys.†

The dose is from ℥ss to ℥j repeated every two or three or four hours. It is frequently given in combination with nitre, antimonials, camphor, and opium.

Citrate of Potash.—There are two forms in which this is prescribed, viz. that of the *neutral saline mixture* and the *effervescing draught.*

The *neutral mixture* is prepared by saturating fresh lemon juice with the carbonate of potassa. Of this half an ounce diluted with an equal quantity of water may be given every two or three hours.

The *effervescing draught* differs from the preceding only in the mode of administration, being taken in the act of effervescence. For this purpose, take carbonate of potass. or soda ʒii, aqua font. ℥iij.

To a tablespoonful of this solution add a tablespoonful of lemon juice, previously diluted with the same quantity of water, and drink in the act of effervescence.

Effects.—This is analogous to the spiritus mindereri, as a diaphoretic; and in addition to this, is refrigerant and gratefully stimulant to the stomach. No remedy is better calculated to allay nausea and irritability of the stomach in fever.

[The antifebrile effect of effervescing draughts is I think increased, if the alkali be in excess. I use tartaric acid and carb. soda, and in the proportions of one part of the former to two of the latter, e. g. tartaric acid ʒi, dissolved in water ℥viij, bi-carb. sodæ ʒii, dissolve in water ℥viij.—Ed.]

Dover's Powder. Pulvis Ipecacuanhæ compositus. Pulvis Ipecacuanhæ et Opii. Pulvis Doveri.—Made by rubbing up *hard opium* ʒi, *powdered ipecac.* ʒi, with *sulph. potassæ* ℥i. This is one of the most valuable and efficient sudorifics we possess, and furnishes a beautiful illustration of the effects and advantages of combining medicines together. Opium and ipecac. both determine to the skin, but neither of them in the way that the compound does. The potash is generally supposed merely to aid in the trituration of the opium. It would seem, however, to aid also in

* P. 220. † Alexander, p. 154.

modifying the general effect of the combination, inasmuch as the opium and ipecac. alone do not produce the same effects. From the nature of its ingredients, this powder is peculiar in its operation, and requires to be given with certain restrictions. *Opium*, while it acts on the skin, shuts up the other secretions, and is stimulant to the brain. It cannot therefore be given where vascular action runs very high, where the tongue is dry, where the bowels are costive, and where the brain is disordered. Again, *ipecac.* affects the stomach; and in consequence of this, Dover's powder is improper when the stomach is irritable. On the other hand, where vascular action is moderate, or has been properly subdued by venesection, where the tongue is moist, the bowels free, the head undisturbed, and the stomach not irritable, it may be used with safety. In all cases where the object is to quiet irritation and pain, and at the same time act on the skin, it is an admirable article, as in dysentery, chronic rheumatism, &c. Dose from five to ten grs.

Eupatorium perfoliatum, known by the common names of *boneset*, *Indian sage*, *thorough-wort*, *cross-wort*, *vegetable antimony.*—It is a plant indigenous to every part of this country, growing from two to five feet high, flowers from July to October, and is found in meadows and near the banks of streams. Although every part of the plant is active, yet the leaves and flowers are the most so. These, therefore, are used with the stems in the form of the *herb*. As found in the market, it is in bundles prepared by the Shakers. Boneset has a faint odor, but an intensely bitter taste; no satisfactory analysis of it is yet made. It yields its virtues both to alcohol and water.

The *effects* of this article differ very much according to the manner of using it. In moderate doses, and in the form of powder or cold infusion, it is tonic. In larger quantities, and in warm infusion it sometimes proves emetic and laxative, but more commonly acts as a sudorific. It is owing to its decided action on the skin that it has received one of its names, "vegetable antimony." Boneset therefore may be considered as a *tonic sudorific*, and as such has been used with much success in fevers, typhoid pneumonia, and rheumatism. The name boneset is said to be derived from its success in a rheumatic fever which prevailed in New England, and was called "break-bone *fever*."

Forms.—As a tonic in *powder*, 20 to 30 grs.; or *cold infusion* (℥i to lb. i boiling water); ℥i 3 or 4 times a day; as a *diaphoretic*, warm infusion, in larger quantities and oftener repeated.

Asclepias Tuberosa, known by the common names of *pleurisy root*, *butterfly weed*, *decumbent swallow-wort.*—A plant two or three feet high, indigenous in every part of the United States, but most abundant at the South. The root is perennial and sends up a number of stems, some erect, others decumbent; differs from the other species of asclepias in not giving out a milky juice when wounded. The part used is the *root*, which

is large and tuberose, externally brown, internally white and striated; when fresh has a nauseous sub-acrid taste; when dried, bitter, but not unpleasant. Powder, dirty white. According to Bigelow, its most abundant soluble portions are bitter extractive and fecula. It yields its virtues to boiling water.

In suitable doses it acts as a sudorific and expectorant, without increasing animal heat or exciting the circulation. On the stomach it proves slightly tonic. If in large quantities it proves laxative. The general effect of this article is to promote the secretions of the mucous membrane of the stomach, bowels and lungs, and of the skin, without any marked effect on the circulation. It has been used with advantage in pulmonary complaints along with suitable depletion. Hence its name, *pleurisy root.* Also in rheumatism.

Forms.—Powder 20 to 30 grs. several times a day. Best form is *decoction* when used as sudorific. Boiling ℥i in quart of water—℥ij every two hours. For children ʒij boiled in pint of milk—℥j two or three times a day. In this way proves diaphoretic and laxative.

Aristolochia Serpentaria.—This is a small plant about eight or ten inches high, growing in the woods in the Middle, Southern, and Western States. The part used in medicine is the *root,* which is perennial, and consists of a number of slender fibres shooting from a horizontal caudex. When fresh the color of the fibres is yellow; by keeping it becomes brown. The powder is of a grey color. Its smell is strong, aromatic, and camphorous. It has a warm and bitter taste.

By analysis this root is found to contain a *volatile oil,* a yellowish *bitter principle, resin, gum, lignin,* and *various salts.*

Its virtues are extracted both by water and alcohol.

Effects.—A stimulant, aromatic diaphoretic, admirably adapted to those forms and stages of fever which are characterized by debility. Generally used as an *infusion.* ℥ss of the root to one pint of boiling water; macerate for a couple of hours and then strain; of this one or two ounces every couple of hours in fever.

EXPECTORANTS.

Expectorants are defined to be "those medicines which facilitate or promote the rejection of mucus or other fluids from the lungs and trachea." —(Murray.)

There is, perhaps, no class of agents which is so much used, and certainly none so much abused as this. They are resorted to on all occasions of cough, without any precise notions as to the mode of their operation or the actual effects which they produce. Hence it is, that in the ordinary course of practice, they do a great deal more harm than good. It becomes important, therefore, that they should be made the subject of special investigation, and with this view, let us look at the nature of the parts upon which they act, and the causes which give rise to difficult or deficient expectoration.

The whole of the air passages are lined with mucous membrane. This secretes mucus, a certain amount of which is necessary to keep the membrane in a state to perform its function, not, for the present, to speak of its importance as an excretion. When this secretion is in due proportion respiration is performed, so far at least as this part is concerned, naturally and easily. There is neither cough nor irritation. It happens, however, from various causes, that this organ becomes disordered, and one of the first and most striking of the effects is a change in the quantity as well as quality of its secretion. Now, the disorder of the mucous membrane is of different characters in different cases, consequently the effect as to the state of its secretion differs very much. In some the membrane becomes inflamed or constricted, and then the quantity of secretion is greatly lessened. Now, the consequence of this is, that when the air in respiration passes over this dry membrane, it causes irritation and produces cough, which is nothing more than an effort to get rid of some irritating cause. In other cases, the membrane may be so disordered as to give rise to an increase of secretion. The effect of this will be, of course, partially to obstruct the tubes and cells through which the air passes in respiration, and this will give rise to cough.

In other cases, again, the membrane may be so disordered as to produce a viscid, tenacious secretion which may adhere to it, and in this way keep up a constant irritation. Now, in all these cases, you perceive the real and primary seat of all the difficulty is in the condition of the mucous mem-

brane of the respiratory organs, and the change which follows as a consequence, in the character and quantity of its secretions.

In the treatment, the great object is, or ought to be, to effect such a change in this disordered membrane, as will restore its secretions to their natural quantity and quality. Now, it is very evident that this must be effected, not by any one set of remedies, but they must be of various kinds adapted to the particular character of the disorder. Among these, what are commonly called expectorants are of the least importance. Still, however, they may be rendered very valuable and useful if properly applied.

In addition to the disordered state of the mucous membrane, there are other conditions of the respiratory organs which require to be noticed, and which give rise to the same difficulty. Excessive quantities of morbid matter may be found in consequence of ulceration, the presence of softened tuberculous matter, or of pus, as in abscess. Now, in all these cases, expectoration may require to be assisted. Again, the bronchial tubes may be the seat of spasmodic stricture, interfering at once with the respiration and the secretion.

Now, the prominent symptom which indicates each of these morbid conditions is *cough*, and the great error in the use of expectorants is, that everything is generally directed to suppress this symptom, and this, not by removing the *cause* of the cough, but by giving *anodynes*. These simply lull the cough, but do not change the condition of the parts—nay, sometimes make it materially worse, and that in two several ways.

1. They check secretion. Now, secretion is nature's mode of relieving overloaded vessels. This relief may be essential to the removal of the disease; opiates render it unattainable.

2. They suppress cough. Here, again, cough is nature's effort to remove something out of the larynx, trachea, or bronchi. Suppress this effort, and the cause of irritation will remain to aggravate the present disease, or perhaps to cause another and more serious one.

Cough is a forcible expiration; and, while it is ordinarily an index of something wrong, some cause of irritation in the lungs, is an effort of nature to get rid of this offending cause. It is a natural, and often a very salutary process. But, like other similar natural efforts, it may be excessive or irregular, and then it may irritate and exhaust the system. Under such circumstances it may be proper to modify or control the action of this agent, so as to secure all its good without any of its evil consequences. But this is to be done by removing the cause of cough, if that be possible, not by suppressing it with opium, as is too much the habit of some. All that opium can do under such circumstances is by diminishing the sensibility to check the efforts of nature to rid herself of the irritating cause. To show how absurd this opium practice is, imagine that the cough were excited by a bean or other physical irritant in the trachea. Who would think of giving opium? Let this analogy guide your practice: *Get rid*

of the bean—remove the cause and the effect will cease. To do this it is, of course, essential that we investigate the case, and ascertain, if possible, the cause of cough. Now, the causes of cough are various :

1. It may arise from disordered conditions of the fauces, especially elongation of the uvula.

2. Disordered conditions of the larynx.

3. Disordered conditions of the mucous membrane lining the lungs, dryness, excessive secretion, adhesion of viscid mucus.

4. Diseased conditions of the substance of the lungs, inflammation, tubercles either solid or in a state of suppuration, abscesses, &c.

5. Diseased conditions of the pleural membrane.

6. Effusions in the cavity of the chest.

7. Diseases of the heart.

8. Finally, it may arise sympathetically from disordered conditions of neighboring organs, such as the liver, stomach, &c.

Now, it must be self-evident that it is only in certain of these cases that pure expectorants are applicable. The proper mode of treatment in all these is to address your remedies to the cause of the cough ; and it is only in this way that you can safely remove it. If you suppress it merely by opiate expectorants, you frequently aggravate the original difficulty, and the relief is only temporary.

The cases where expectorants are salutary, are principally those in which the mucous membrane of the lungs is disordered.

What I wish to impress on your minds is, that you should have correct notions of the nature of cough, and not look upon it as a thing to be put down by specific remedies. It is merely a symptom of disease, and not the disease itself. Do not, therefore, be in a hurry to suppress it at once in all cases. Treat it as you would a case of dysentery.

What do you do in a case of that kind ? You don't depend on opium to check the tenesmus and frequent evacuations, but you give with it remedies to allay the inflammation of the intestines ; and, if the symptoms abate under this kind of treatment, you are sure your patient is really getting well, and the symptoms not merely smothered up. So, in a case of cough, if it abate under the use of remedies addressed to the cause of a cough, you will find your cough mitigated in the only way it ought to be.

PRACTICAL APPLICATIONS.

I come now to treat of the use and application of expectorants. The only diseases of course in which they can be used are those of the air passages. Each of these I shall briefly notice.

1. *Laryngitis.*—From the violence of this affection and the rapidity with which it runs its course, nothing is to be expected from simple expec-

torants. Active remedies may be beneficial, and of these I have already spoken.

2. *Trachitis.*—This is an inflammation of the mucous membrane lining the trachea. An analysis of the different stages through which this affection passes will show how far expectorant agents may be rendered available. For practical purposes croup may be divided into three stages. In the *first* or *forming stage* the disease is purely local and consists essentially in a strictured condition of the extreme vessels of the mucous membrane of the trachea. In this stage, by the prompt administration of relaxing emetics, such as tartar emetic and ipecacuanha, it may be completely broken up. By the peculiar operation of these agents the stricture is relieved, the secretions of the part restored, and general relaxation of the system induced. In the *second* or *inflammatory stage*, the disease becomes changed from a purely local one; active inflammation of the part now exists, accompanied by general inflammatory excitement. In this condition of things it becomes necessary to resort to the use of the most potent antiphlogistic remedies, and among these venesection, tartar emetic, and calomel are the most prominent agents.

In the *third* or *last stage* the general excitement subsides and the local inflammation terminates in an effusion of coagulable lymph, constituting the false membrane which lines the inner surface of the trachea. In this stage the object is to separate and cause to be thrown off, if possible, this membrane. As at this time the strength is very much impaired, and in fact a collapse of the system has ensued, a class of medicines are to be used entirely different from those which are proper in the other stages. All debilitating remedies are now of course improper and injurious; on the contrary such articles are now to be resorted to as while they do not impair the general strength have the effect of promoting the secretions from the trachea and of facilitating the rejection of whatever matters may be accumulated. For this purpose the vitriolic emetics are found useful, but more especially the polygala seneka. This keeps up a local stimulant action upon the trachea, followed by copious secretion and frequently produces the most beneficial consequences. By Dr. Archer the use of the snake root is recommended in all stages of the complaint, and in many cases, provided venesection be properly premised and tartar emetic be duly exhibited to keep down excitement, it may be advantageously prescribed. The Hive syrup of Dr. Coxe is an excellent combination for obtaining the peculiar and specific effects of the seneka without the danger resulting from its stimulant operations.

3. *Bronchitis.*—This is of two kinds, the *acute* and the *chronic.*

Acute Bronchitis.—In this form of it all agents calculated to produce a relaxing effect upon the inflamed membrane and promote the secretions from it may have a salutary influence. With this view *tartar emetic* may be used with great freedom, and it will be found to act beneficially not

merely by its relaxing effect on the inflamed membrane, but by its general antiphlogistic operation on the system at large. *Ipecacuanha* may be used also with the same view. The inhalation of warm aqueous vapor will also be found useful. In short, whatever has a tendency to relax the inflamed surface, promote secretion from it, and at the same time lessen general excitement, may be used as an expectorant. Either of these emetic substances may be pushed to free vomiting with great advantage after due depletion. This is most especially required where the expectoration is difficult and where the cough is suffocating. In children, in whom expectoration is always a difficult process, they are remedies of great importance. Vomiting operates beneficially in more ways than one. It unloads the bronchial tubes of collections of mucus and thus relieves the lungs, at the same time that it lessens excitement and determines to the surface. For adults the *tartar emetic* is the best; for children *ipecacuanha.* With the exception of the articles just mentioned expectorants are remedies not merely of doubtful efficacy, but productive of mischievous consequences. Especially all such as produce a stimulating effect are improper. On this account *squills*, *ammoniac* and all others of an analogous character are altogether out of the question whenever fever or general excitement is present. The idea in which they are generally used is that the expectoration is a salutary discharge calculated to relieve the disease and therefore ought to be encouraged. Now this is only true to a certain extent. The matter expectorated is nothing more than the result of the inflammatory action in the mucous membrane, and to encourage the increase of this to the extent proposed by some would be about as sensible as to encourage the morbid discharges in dysentery with the idea of relieving that disease. The principle, therefore, on which stimulating expectorants is used is erroneous. They may increase the expectoration, but they do so by increasing the diseased condition of the part on which expectoration depends. All that you want to accomplish by expectorants in these cases is simply to aid in throwing off what is actually secreted by the diseased membrane, and to restore as far as possible the natural healthy secretions of the part. Anything going beyond this must be injurious.

Chronic Bronchitis.—In this form of the disease expectorants of various kinds are remedies almost universally resorted to. Let us see upon what principles. In this disease there is a chronic inflammation of the mucous membrane accompanied with excessive determination of fluid to the part, and a consequent excessive secretion from it. This is the simple condition of the parts. Now so far as expectorants aid in throwing off matter already secreted into the bronchial cells, and so far as they have a tendency to alter the condition of the mucous membrane which keeps up this secretion, so far they may be beneficial. When, however, they go beyond this, when they stimulate the mucous membrane so as to increase the secretions, they necessarily do harm. By the determination which they

keep up to the part they continue the morbid condition of the mucous membrane upon which the whole difficulty depends. Here it is that such articles as squills which are in such common use frequently do more harm than good.

As occasional remedies to unload the lungs, *emetics* are remedies of great value. Among these ipecacuanha and in some cases the sulphate of zinc answer the best purpose.

Inhalations of various substances may be used with considerable advantage in this form of disease. Vapors of *tar*, the *balsams*, *iodine*, and *chlorine* have all proved more or less beneficial. A good deal of the success attending these remedies must necessarily depend upon the way in which they are used. Much harm has been done, for instance, no doubt by inhaling them without being sufficiently diluted with the surrounding atmosphere. When this is the case, it is very evident that they may prove injurious by acting as mere irritants.

4. *Pneumonia.*—This is an inflammation of the substance of the lungs, and is to be treated by the most active remedies. Among these, venesection, calomel, and tartar emetic hold a prominent place. By resolving this inflammation, these promote expectoration, in the only way in which it ought to be promoted.

5. *Asthma.*—Various opinions are entertained in relation to the proximate cause of this disease. It comes on in paroxysms, and the treatment of it is to be divided into that which is proper during the paroxysm, and that during the intermission. Now it is mainly during the *paroxysm* that the agents belonging to this class are found useful. *Emetics* have already been spoken of under that head. They are prompt and efficacious remedies both to relieve spasm and remove accumulations of mucus. Among these, *ipecacuanha* is the best—in some cases, *tartar emetic*. *Expectorants*, though generally prescribed, are proper only in certain cases. In relaxed habits, where the pulse is slow and feeble, and no excitement present, *squills*, *ammoniac*, &c., may be useful. Wherever inflammatory action is present, these articles must do harm. The smoking of *tobacco* and *stramonium* frequently proves beneficial, as do also the inhalation of relaxing and narcotic vapors.

MODES IN WHICH EXPECTORANTS PROVE CURATIVE.

1. Expectorants prove curative by *preparing* the matter to be brought up by coughing. The way in which they do this must of course vary according to the condition of the lungs.

2. In some cases, they act by promoting secretion where the secretion is deficient.

3. In some, by diminishing secretion where it is excessive.

As in these cases the state of the mucous membrane of the lungs must differ very materially, the great art in the use of expectorants is to select such as are appropriate to the case. Some are relaxing—some stimulating.

VARIOUS MODES IN WHICH EXPECTORANTS MAY BE MADE TO AFFECT THE SYSTEM.

(*a.*) By direct application to the lungs.—(Inhalation in the form of vapor.) This is the most direct way in which expectorants can be introduced. They come in immediate contact with the disordered structure, and produce their effects by the changes which they thus occasion in it.

(*b.*) By being slowly dissolved in the mouth, and making a certain impression on the fauces, which is sympathetically transmitted down the mucous membrane of the trachea and bronchiæ. That impressions can thus be transmitted, is a fact well established. This is the way in which the salutary effect of liquorice and other demulcent substances is to be explained.

(*c.*) By being taken into the stomach and absorbed, they make their impressions to the mucous lining of the lungs. This they may do either by direct action, subsequent to their absorption, or by affecting the mucous membrane through the general system.

Rules to be observed during the Administration.

(*a.*) Determine as distinctly as possible what the actual condition of the pulmonary organs is, and settle in your own mind what your precise object is in prescribing the remedy. In no class of remedies is such a caution more absolutely necessary, because in the use of none is there such constant empiricism practised. Even intelligent physicians are too apt to prescribe them as a mere matter of routine, without attaching those precise ideas to their action, which are essential to the proper exhibition of all medicines.

(*b.*) Having determined what the precise condition of the mucous lining of the lungs is, a proper selection of the appropriate article must be made. To do this requires, of course, an accurate knowledge of the distinctive properties of these articles. An error in this respect may be attended with very unpleasant circumstances.

(*c.*) During the use of expectorants, to obtain their beneficial effects, it is important to keep up a due degree of warmth on the surface. From the sympathy existing between the lungs and the skin, it is well known that the former are very much relieved by keeping up a determination to

the latter, and expectoration is generally more free when the surface is relaxed.

(*d.*) To gain the full beneficial effects of expectorants, all determination to the urinary organs should be avoided.

(*e.*) Another rule generally insisted upon is, to avoid purging during the use of expectorants. This, however, must be taken with certain restrictions.

(*f.*) As the impression they make is only temporary, they should be repeated at short intervals.

(*g.*) A free use of warm diluents aids their effects.

CLASSIFICATION OF EXPECTORANT AGENTS.

As the morbid condition for which expectorants are prescribed may originate from different causes, or rather, be associated with different conditions of the lungs, it is very evident that the manner in which they operate must vary according to these different conditions. Upon this principle, therefore, a useful and practical classification of them may be made in the following way.

1. Those agents which have the effect of relaxing the exhalant vessels of the mucous membrane, restoring the natural secretions of the part in such manner and degree as that the natural effort of coughing may bring them up.

(*a.*) Substances applied directly to the lungs.

1. Vapor of hot water.

(*b.*) Substances taken into the stomach.

1. Ipecacuanha.
2. Tartar emetic.
3. Demulcent substances.

2. Those agents which have the effect of stimulating the extreme vessels of the mucous membrane, and in this way aiding expectoration.

(*a.*) Substances applied directly to the lungs.

1. Chlorine.
2. Balsam of Tolu.
3. Iodine.
4. Tar.

(*b.*) Substances taken into the stomach.

1. Polygala seneka.
2. Sanguinaria Canadensis.
3. Gum ammoniac.
4. Asafœtida.
5. Balsam of Tolu.
6. Balsam of Peru.
7. Balsam copaiva.
8. Scilla maritima.
9. Alum triphyllium.

3. Those agents which have the effect of allaying spasm.

(*a.*) Substances applied directly to the lungs.

1. Tobacco smoke.
2. Stramonium.
3. Sulphuric ether.

4. Those which operate by producing an emetic effect.
   1. Emetic substances.

INDIVIDUAL EXPECTORANTS.

RELAXING SUBSTANCES.

1. *Vapor of Hot Water.*—This is the simplest and perhaps most efficacious of all the articles that can be used in the way of inhalation. A common and very good way of doing this is simply to inhale the steam from the spout of a tea-pot containing warm water, or from a jar or pitcher.

A more perfect contrivance is the inhaler originally constructed by Mudge.

Effects.—The effects of this application are obvious. It relaxes the extremities of the vessels of the mucous membrane—causing them to secrete freely—and in this way resolving stricture and inflammation. By Mudge this remedy was originally recommended in combination with opium, in cases of incipient catarrh, and by him was used with great success. It is certainly rendered more efficacious by throwing an ounce of paregoric into the water.

Ipecacuanha.—Of this article I have already spoken very fully under the head of emetics, and I have shown that it produces a similar effect on the mucous membrane, not merely of the stomach but of the fauces and bronchial tubes—promoting secretion and relaxation of this membrane.

It is in consequence of these properties that it is used as an expectorant and proves so very valuable. It may be given alone simply mixed in water, in doses of grs. j or ij—repeated according to circumstances—or made up into pills of grs. j each with soap, to be repeated two or three times a day. The more common mode, however, of using this article is in the form of syrup of ipecac in combination with demulcent and other articles.

Tartar Emetic.—Of all the articles belonging to the class of relaxing expectorants, this is the most effective. It controls the circulation—acts upon the extreme vessels of the system at large—promotes secretion and exhalation, and in all these various ways proves beneficial as an expectorant. Indeed it forms the efficient basis of most of the mixtures of this kind that are used. As an expectorant it is to be given in minute doses of $\frac{1}{12}$ or less of a grain, frequently repeated. During its use it is exceedingly important that the body should be kept warm.

DEMULCENT SUBSTANCES.

A great variety of these are used with great advantage for allaying pulmonary irritation and producing relaxation of its vessels. Liquorice, gum arabic, &c., are among the best. They enter largely into the composition of expectorant mixtures.

STIMULATING SUBSTANCES.

INHALATIONS.—*Chlorine.*—The properties of this substance you are all acquainted with. Its uses in a medical point of view, though limited, are exceedingly important. As a disinfecting agent it has long been celebrated. It has had considerable repute as a remedy in cases of pulmonary consumption, and the mode of using it is that of inhalation or breathing an atmosphere impregnated with it. The way in which it first attracted attention as a remedy in consumption was by the fact having been observed that those employed in manufactories where chlorine is freely extricated (as in bleaching establishments, &c.) were greatly relieved and even cured of pulmonary affections under which they had been previously laboring.

Effects.—When cautiously and gradually inhaled the evident effects are a slight sensation of constriction in the thorax, with some increase of cough; in a few instances a trifling degree of vertigo has been experienced, but those feelings rapidly subside; expectoration is produced almost without an effort, and the patient gradually becomes more comfortable than before inhaling the gas.

If used without dilution the chlorine produces irritating effects upon the lungs. They are, however, only temporary, soon pass off and leave no bad effects behind. In the manufactories large quantities are constantly inhaled without any evil consequences.

Balsam of Tolu.—By pouring a pint of boiling water upon one ounce of balsam of Tolu, a good stimulating inhalation may be formed which may be advantageously used in debilitated states of the lungs, or when they are overloaded with viscid mucous accumulations. It may be inhaled through Mudge's inhaler or a common tea-pot.

3. *Iodine.*—This is a remedy from which much was at one time effected, but it is now very little used.

4. *Tar.*—Tar is a well known substance, and its inhalation in the form of vapor has gained no little celebrity in certain diseases of the pulmonary organs. The best mode of using this, is simply to put a pint of tar into a proper dish in a room of some size, a spirit lamp is then placed under it,

and in a very short time the whole atmosphere of the apartment will be charged with the vapor. This remedy is now very little used. In some chronic irritations of the lungs it may do good.

Polygala Senega.—This is commonly known by the name of the *Seneka Snakeroot.* It is a native of this country, and grows wild in every part of the United States, but more especially in the southern and western states. It consists of several slender erect stems, sent up from a single root, which is perennial. It grows to the height of about a foot, and flowers in June and August. The part used in medicine is the *root.*

Physical Characters of the Root.—The dried root as found in the shops varies in size from a common quill to that of the little finger. It is very much twisted, filled with hard eminences, and terminating in a knotty head. There is a peculiar projecting line extending from one extremity of the root to the other. The cortical part is thick, hard, and resinous, and of a grey color. It is in this that all the active properties reside. The internal part is ligneous, white, and inert. The odor, though strong in the fresh root, is very faint in the dried; its taste at first is sweetish, and somewhat mucilaginous, becomes, after being chewed a few seconds, pungent and acrid, producing a degree of irritation about the fauces, and a tendency to cough and salivation. The powder is of a grey color.

The virtues of the root are extracted by boiling water, and by diluted alcohol.

Effects.—The first effect produced by this article is a peculiar sensation in the fauces and œsophagus, which is compared to that of burning. This comes on a few minutes after it is swallowed, and is followed by a considerable secretion and a discharge, by hawking of mucus from the fauces and trachea.* From an ordinary dose these sensations continue one or two hours. To this succeeds nausea, and sometimes actual vomiting. In some cases slight catharsis is also produced. The pulse is always increased in force and frequency. According to the experiments of Dr. Massie, from the administration of a single dose, the pulse becomes accelerated in about ten minutes, but returned to its natural beat in from one to two hours. In some cases it extends its action to the uterus, promoting the menstrual discharge. By some, too, it is asserted that it possesses the power of calling the pregnant uterus into action, and with this view it has been used as a means to promote abortion.

The principal action of this agent seems to be directed to the gastro-pulmonary mucous tissue, and it may be used wherever it is desirable to make a stimulating impression upon this tissue with the view of promoting free secretion.

The history of the introduction of this article into practice is the following:—Upwards of a hundred years ago (1735) a respectable physician of

* Massie, p. 191.

Virginia, Dr. Tennent, first obtained a knowledge of the use of this remedy from the Senagaroo Indians, by whom it was considered as a specific against the bite of the rattlesnake. From his own experience he was induced to believe in its virtues in these cases, and from the analogy which he supposed to exist between these and pleurisy, he recommended it also in this disease. In 1739 he wrote and published a pamphlet on the subject —one of the earliest medical publications which appeared in this country. About forty years ago, it was first recommended by Dr. Archer, of Maryland, as an important remedy in cynanche trachealis, a disease in which it still retains its reputation.

Form of Administration. Substance.—In powder, the dose is from ten to twenty grains.

Decoction.—This is the best form in which it can be used. It is prepared by boiling ℥ss of the bruised root in a pint of water, until it is reduced to half a pint, and then straining. Of this, to a child, a teaspoonful is to be given every half hour or hour, according to the urgency of the symptoms, and at intervals a few drops to keep up the stimulus until it acts either as an emetic or purgative.

To an adult give ℥ij to ℥iij.

Syrup of Senega, U. S. Disp. dose, ʒi to ʒiij.

Scilla maritima.—Under the head of Emetics, this substance has been already described. The general operation of the squill is stimulant. Upon the mucous membrane of the lungs it acts in an especial manner, exciting and promoting its secretory process. When given in considerable doses the squill acts powerfully on the nervous system, producing nausea, diminishing the action of the pulse, &c. As a remedial agent it may be used in all those cases of disease of the pulmonary organs, where the exhalants of these organs are in a debilitated state, and, as a consequence, where the bronchial tubes are crowded with mucus.

The common form in which it is used as an expectorant is the oxymel or syrup. Dose, 30 drops to ʒi.

Sanguinaria Canadensis.—This plant is known by a variety of common names, such as the *blood root, puccoon, red root, blood wort, red turmeric, Indian paint, &c.* This latter name is derived from the use made of it by the Indians as a paint, not merely for their own persons, but for their baskets and various other articles. It is a beautiful delicate perennial vegetable, growing to the height of six or eight inches, and terminating in a single flower. It grows in abundance in almost every part of the United States, and is one of the earliest plants flowering in the spring. Every part of the plant possesses active properties, but the root only is used. This is from two to three or four inches in length, and from a quarter of an inch to an inch in thickness, and of a fleshy consistence. Externally it is reddish brown, internally bright red. When cut or broken, it pours out from numerous points of the surface a bright orange colored juice of a

bitter taste. From this it derives its name of *blood root*. The same juice pervades every part of the plant. By drying, it loses 70 per cent. of its weight, diminishes somewhat in size, and becomes wrinkled and twisted. Its taste is bitter and acrid, leaving a durable sense of acrimony in the fauces. Its odor is slightly narcotic. The color of its powder is a brownish orange red.

By Prof. Dana, an alkaline principle was detected in this root, which he called *sanguinarine*. Blood root yields its virtues to water, wine, and alcohol, though in different proportions. The watery preparations are more nauseating, but less bitter and acrid than the alcoholic.

Effects.—These vary very much with the dose. If the powder be snuffed, it irritates the schneiderian membrane, causing sneezing and increased secretion from the part. Taken internally in *small aad repeated* doses, it makes a peculiar impression on the mucous membrane of the stomach, increasing secretion, exciting the appetite, and improving digestion. The liver is also excited into action, in consequence of which increased secretions of bile take place.* On the mucous tissue of the pulmonary organs an analogous effect is produced, and increased secretion succeeds. During its use in this way the pulse is gradually and moderately increased in force and frequency. Sometimes it excites the menstrual secretion, and in some cases, according to Dr. Tully, "it has been known to produce uterine hæmorrhage."†

In *larger doses*, it produces nausea, and abates the force and frequency of the pulse.

In *still larger doses*, it produces prompt and active vomiting.

If the dose be *excessive*, it causes vomiting, burning in the stomach, faintness, vertigo, diminished vision, coldness, extreme reduction of the pulse, and great prostration.

From the foregoing, therefore, the uses of this article must be various. According to the manner in which it is used, it operates as an alterative, an expectorant, an emetic, or a narcotic.

This article resembles colchicum a good deal.

Forms of Administration. Substance.—The best form of giving this is in pill, in consequence of the irritation which the powder produces in the fauces. When the alterative and expectorant effects are required, five grains in pill may be repeated every two or three hours. For an emetic, from ten to twenty grains is a dose.

Tincture.—This is prepared by macerating four ounces of the bruised root in two pints of diluted alcohol, for fourteen days, and then straining. Of this, from 20 to 30 drops, repeated every two or three hours, increasing the quantity as the stomach will bear, to 60 or 100 drops, may be given

* Tully. † P. 25.

as an alterative or expectorant. As an emetic, from two to four drachms will be a sufficient dose, repeated, if necessary, till it operates.

All the preparations of Sanguinaria are impaired by keeping.

Arium triphyllum.—This is known by the common names of the *Indian turnip*, *Dragon root*, and *Wake robin*. It is a native of this continent, grows in every part of the United States, and is found generally in rich, swampy, and shady grounds. The part used in medicine is the *root*, which is bulbous like the common turnip. It is about one or two inches in diameter, covered with a brown, wrinkled epidermis, and internally white and solid. In its fresh state, the root has a peculiar smell and an extremely acrid taste; and when chewed, causes a severe sense of burning and pricking in the mouth, which continues for several hours. When dried, it produces no effect of this kind. This acrimony appears to depend upon a peculiar principle, which is exceedingly volatile, and is generally dissipated by drying or simple exposure to the air. So completely is this dissipated by the application of heat, that it is converted into a mild, farinaceous, and nutritious substance, resembling starch. According to Dr. Bigelow, it appears that the active properties of this substance are not imparted to any menstruum, neither water, alcohol, ether, nor olive oil.

Effects.—In its recent state this root is a powerful local stimulant. It causes a peculiar impression on the mucous membrane of the mouth and throat, stimulating it, and producing copious secretion from surrounding glands. The same impression is made on the mucous membrane lining the œsophagus and stomach, as well as that of the trachea and lungs. On the circulation its effect is stimulant, although not so much so as might be supposed from the local effect which it produces on the mouth. The use of this article is principally limited to those cases in which a stimulant impression is required to be made upon the mucous lining of the fauces and pulmonary organs, with the view of producing secretion. Hence, it has been used in chronic catarrh, pertussis, asthma, &c.

Mode of Administration.—In its recent state it is too acrid for use. When perfectly dried it is inert. The recently dried root which still retains a sufficient portion of the acrid principle, is the state in which it is used. By burying the root in sand, and keeping it in a cellar, it may be preserved for a great length of time fit for medicinal use; it may also be preserved by keeping it in tightly stopped bottles after it has been dried. As the properties of this root are not imparted to any menstruum, the best form of giving it is substance, in doses of six or ten grains (gradually increased) of the powder, two or three times a day. This may be taken mixed in milk.

The powder made into a paste with honey or syrup, and put into the mouth, forms a good local application for aphthæ in children.

Gum Ammoniac.—This is the product of the *Dorema ammoniacum*, a

plant growing native in Persia. It rises to the height of six or seven feet, the part used is the concrete juice. The whole of the plant is pervaded by a milky juice, which exudes from it on the slightest puncture. In the month of May, the plant is attacked by an insect of the beetle tribe, which pierces it in all directions. From these punctures the juice exudes and concretes, and is then collected by the natives. It is sent to India, from whence it is brought to Europe. Ammoniac comes in two forms—either in separate dry tears (*ammoniac in the tear*), or in masses composed of agglutinated tears (*lump ammoniac*).

In the form of *tears*, ammoniac is irregular in its shape, generally more or less globular. Externally, of an opaque yellowish color; internally, whitish; at ordinary temperatures, moderately hard and brittle; but softening in the hand like wax. The *masses* are of a darker color, and less uniform in their structure. They are composed of agglutinated tears imbedded in a brownish substance, and frequently mixed with various impurities, such as fragments of vegetables, sand, &c.

Gum ammoniac has a faint, unpleasant smell. This odor is peculiar, and by it the gum may be identified. Its taste is bitter, nauseous, and somewhat acrid.

According to the analysis of Bucholtz, this substance contains in 100 parts, 72 resin, 22.4 gum, 1.6 bassorin, 4 volatile oil, including loss and water.

Ammoniac is partly soluble in water, alcohol, ether, and vinegar. When triturated with water, a milky solution is formed, which, after standing a short time, precipitates a resinous deposit. As all the virtues of the ammoniac reside in the gum, the proper menstruum is water.

Effects.—Gum ammonia is stimulating in its operation, and exerts its effect chiefly on the mucous membrane of the pulmonary organs. According to the condition of these organs, it either lessens or increases secretion and expectoration. Where secretion is excessive from debility, it lessens it, and where it is scanty from torpor, it promotes it. Its most common use now is as an external application, combined with mercury.

Form.—*Substance* in the form of pill in doses of from ten to thirty grains.

It enters into the composition of the *compound squill pill*, noted in chronic coughs.

Mistura ammoniaci, commonly called the *lac ammoniac*, made by rubbing up ʒ ii of pulverized ammonia, with ℥ viij of water. On standing, the resin subsides. ℥ ss at a dose three or four times a day.

In the form of plaster, a good local stimulant and discutient.

Emp. Ammoniaci cum Hydrargyro is the best form, and is an excellent application to indolent tumors. It is sometimes put over the liver to relieve congestion of that organ. It has produced, when thus used, ptyalism.

Balsam of Peru.—This is the product of the *Myrospermum peruiferum*, a tall and beautiful tree growing in various parts of South America, especially Peru, New Granada, Columbia, and Mexico. The wood of the tree is very durable, and is employed for the purpose of building.

There are two ways in which the balsam is obtained. The first is by incisions into the bark of the tree, the second is by boiling the trunk and branches in water. When *incisions* are made into the tree, the balsam oozes out in a *white liquid* form, which, if collected in bottles, may be preserved in a fluid state for many years. This is called the *white liquid balsam;* when collected in mats and calabashes, it concretes into a resinous state, and is then called the *dry white balsam.*

When the balsam is obtained by *boiling* the bark of the tree or the smaller branches in water, a dark-colored fluid is obtained, which is called *black Peruvian balsam.* This remains liquid, and is the balsam of Peru known in medicine.

This article is brought into this country in tin canisters, and is a viscid fluid, of a dark reddish brown color, of the consistency of syrup or treacle, has a fragrant odor and a warm acrid taste, leaving, when swallowed, a pricking sensation in the throat.

According to the analysis of Stolze, balsam of Peru contains in 100 parts

Brown resin (nearly insoluble), .	2.4
Brown soluble resin, ...	20·7
Peculiar vol. oil, ...	69·00
Benzoic acid, ...	6·4
Extractive, ...	0·6
Dross and moisture, ...	0·9
	100·00

Alcohol in large proportion entirely dissolves balsam of Peru. Boiling water extracts the Benzoic acid.

Purity.—Sometimes adulterated with *fixed oil;* sometimes with *alcohol.*

The first of these is detected by dissolving in alcohol. If *pure*, it is entirely dissolved. If any *fixed oil* is present it will not dissolve.

The second is detected by mixing it with water, and shaking in a graduated glass tube. If mixed, the liquor becomes milky, and after it has settled, and the balsam and water have separated, the balsam is found to have diminished in bulk, and the water to have increased. This is owing to the alcohol uniting with the water and leaving the balsam. The loss of bulk of the balsam indicates the extent of the adulteration.—D. Chem.

Effects.—A stimulating expectorant. In full doses it is apt to quicken the circulation and create thirst. As a local application, it is a useful stimulant in exciting indolent ulcers, &c. Not much used internally.

Dose.—Twenty-five to thirty drops, taken on sugar, or made up into pill, three or four times a day; or it may be made up into the form of emulsion with gum or yolk of egg. A good form is the following.

℞ Bals. Peruvian. ʒ ss
Mucil. acaciæ, ʒ ij, tere simul et adde
Aq. cinnamom. ʒ ss
Aq. distillat. ℥ ss M. ft haustus.
Ter in die sumendus. Brande.

Balsam of Tolu.—This has generally been supposed to be the product of the *Balsamum toluifera.* It is now, however, considered as the product of *Myrospermum toluiferum*, a beautiful tree growing in various parts of South America, especially in Carthagena, and the mountains of Tolu.

The balsam is obtained by incisions made into the bark of the trunk and larger branches, from which it oozes out, and is collected in different sorts of vessels. It is brought to this country from Carthagena in tin canisters, earthen jars, and sometimes in calabashes. When first imported, balsam of Tolu is a viscid tenacious fluid, of a yellowish brown color, with a highly fragrant odor and an aromatic sweetish taste. By keeping, it becomes hard and brittle, like resin, having something of a crystalline appearance.

According to analysis, it contains in 100 parts, eighty-eight parts of *resin*, 12 *Benzoic acid*, and 0·2 *volatile oil.* It is entirely dissolved by alcohol; boiling water extracts its benzoic acid.

Effects.—The same as the balsam of Peru, a stimulating expectorant, used in chronic catarrhal affections, promoting the secretions of the mucous membrane of the lungs, when deficient from torpor. From its pleasant flavor it is much used as an adjunct to expectorant mixtures.

Mode of Administration.—Dose from ten to thirty grains, frequently repeated, made into an emulsion by trituration with gum arabic and sugar.

Tincture.—ʒ ss to ʒ ii. From its stimulating nature not much used alone—generally added to other mixtures.

Syrup.—This is inert as a medicine, and is generally used to flavor other expectorant mixtures.

Myrrh.—This is the product of the *Balsamodendron myrrha*, a small tree growing in Arabia Felix. The part used in medicine is the juice, which exudes spontaneously (like the cherry tree gum) from the bark of the tree, and concretes upon it. When it first exudes, it is of a soft, oily consistence, and of a yellowish color. As it dries it becomes darker and redder in its color. Formerly the best kind of myrrh was imported from Turkey, and called *Turkey myrrh*, while an inferior kind was brought from India. At present Pereira says the greatest part is brought from the East Indies. "It is said the India myrrh is collected in Abyssinia, and

thence taken to the ports of Hindostan, while that which goes under the name of Turkey myrrh, is brough from Arabia by the route of Egypt." —U. S. Disp.

Myrrh comes in small irregular fragments like tears, or in large masses composed of agglutinated portions. When good, it is of a reddish yellow color, and translucent, has a fragrant odor, and a bitter aromatic taste. These are the properties of Turkey myrrh. The East India is frequently much inferior in quality. It is much darker colored, more opaque and less odor. It also abounds more in impurities.

According to the analysis of Brande, myrrh contains in 100 parts,

Volatile oil,	2.60
Resin soft,	22.24
—— hard,	5.56
Gum soluble,	54.38
—— insoluble (Bassorin),	9.32
Salts of potassa and lime,	1.36
Loss and impurities,	4.54
	100.00

Myrrh is partially soluble in water, alcohol, and ether.

Effects.—Myrrh is stimulant and tonic in its operation. Its effects are developed principally upon the lungs and upon the uterine organs. It is accordingly considered as an expectorant and emmenagogue, as it is stimulant in its action; it can only, of course, be used in cases marked by debility, and where there is a total absence of febrile and inflammatory excitement.

The diseases in which it has been used are chronic catarrh, humoral asthma, phthisis pulmonalis, and other pulmonary affections, in which there is excessive secretion, but a deficiency of power to expectorate. Also in amenorrhœa, chlorosis, &c.

It is also used with advantage as a local stimulant to spongy gums, ulcerated throat, foul ulcers—very little used alone.

Form of Administration.—It may be given in powder or pill in the dose of from 10 to 30 grains.

It is generally, however, given in combination, and enters into the composition of a number of officinal preparations; among these the following are the most important.

1. *Mistura Ferri composita.*
2. *Tinct. Aloes cum Myrrh.*

ANTISPASMODIC EXPECTORANT ARTICLES.

To this general head belong all the relaxing articles. There are a few, however, which may be said to operately more directly upon the pulmonary organs in the way of allaying spasm.

1. *Tobacco in the form of Smoke.*—Tobacco operates in two ways upon the pulmonary organs, in both of which its influence may be salutary. In the first place, it produces a certain effect upon the mucous membrane lining the respiratory tubes, causing increased secretion from it, and in the second place, by its general narcotic influence on the nerves and on the circulation it allays irritation and alleviates cough. In spasmodic affections of the chest, such as asthma, smoking has accordingly been used frequently with advantage.

2. *Stramonium in the form of Smoke.*—The general effects of stramonium as a narcotic will be noticed under that head. Introduced into the system in the form of smoke of the dried herb, it has long been a popular remedy in spasmodic asthma, and in many cases, unquestionably, has proved beneficial. Like tobacco, it operates locally and generally. It allays irritation of the mucous membrane, and thus promotes free secretion, while at the same time, by its general operation on the nervous system, it counteracts spasm and renders respiration more free and uniform.

3. *Vapor of Sulphuric Ether.*—This is used by simply putting a couple of teaspoonfuls of ether into a cup and holding it to the mouth. The warmth of the hand applied to the cup is sufficient to cause an evaporation of the ether which is thus inhaled. This may be repeated three or four times a day, and is useful in catarrh and whooping cough.

THOSE EXPECTORANTS WHICH ACT BY PRODUCING EMESIS.

The act of vomiting may prove curative in diseases of the lungs in two ways.

1. By its general operation on the circulation and on the secretions of the mucous lining of the lungs. In this way it promotes secretion in some cases, and separates viscid secretions already formed in others.

2. By expelling secreted matters. During the contraction of the diaphragm and abdominal muscles an impulse is communicated to the whole bronchial system. In consequence the expiratory effort is increased, and the expulsion of mucus and other matters from the pulmonary tubes is brought about.

Now the kind of emetic used must differ according to the condition of the system.

If inflammation be present tartar emetic, ipecac and such articles as nauseate must be used.

If there be no fever or inflammation, but simple accumulation of mucus or pus, sulphates of zinc and copper.

In children this distinction is essential.

COMBINATIONS OF EXPECTORANTS WITH ONE ANOTHER.

There is perhaps no class of medicinal agents more uniformly given in combination than expectorants, and there can be no question with the greatest advantage. The principle on which these combinations are made is simple and obvious, and it is that of uniting the different modes in which these agents produce their effects. As already stated some expectorants operate locally and directly upon the lungs. Others produce their effects by impressions made upon neighboring parts and transmitted to the lungs. Now to a greater or less extent the effect of these different modes may be united in one prescription. For the purpose of illustrating this let us run over some of the articles belonging to this class.

Demulcent substances, such as liquorice, gum arabic, &c. These are given alone in the form of solutions when you wish simply to obtain their soothing effects upon the fauces. Most usually, however, they are given in combination with other substances to render them more efficient. They form the basis of almost all expectorant mixtures.

Ipecacuanha.—This is frequently given alone. Usually it is added to the demulcent vehicles already mentioned, and in that way you get an excellent and efficient combination calculated to soothe irritation, promote secretion, and moderately relax the system.

Tartar Emetic.—This, as an expectorant, is usually given in combination with demulcent articles, and you then get the soothing effects of the latter with the peculiar and relaxing effects of the former. This forms the active ingredient in all the expectorant mixtures which are given in cases where inflammatory action is present. The antimony may be added either in the form of tartar emetic itself or of the antimonial wine.

Polygala Senega.—Sometimes this is prescribed alone and you then get the peculiar effects of the remedy upon the mouth and fauces and upper part of the trachea, causing copious secretions from these parts. The polygala is, however, stimulating in its nature, and therefore in cases where this might prove objectionable it is advantageously combined with tartar emetic. A valuable combination of this kind is the *Hive syrup* of Dr. Coxe. This is prepared in the following way.

℞. Polygal. Seneg. contus.
Scillæ Marit. contus. āā ℥ viij.
Aq. puræ ℈ viij.

Boil together over a slow fire till the water is half consumed, strain off the liquor, and then add of strained honey four pounds. Boil the honey and

the strained liquor to six pounds, or to the consistence of a syrup, and add to every pound of this sixteen grains of tartar emetic, that is one grain to every ounce. The dose varies from ten drops to one or more teaspoonfuls every quarter, half, or one hour, according to the age of the patient or the violence of the disease. This combination proves expectorant, emetic, purgative, and diaphoretic.

Scilla maritima.—This is generally given in combination either with tartar emetic, antimonial wine, or ipecacuanha wine, and you then get the united operation of the two ingredients—the peculiar effect of the squill on the mucous lining of the lungs and the general relaxing effects of the antimony on the system. Accordingly it is observed that when the skin is hot and dry the squill does not prove expectorant unless thus combined with a relaxing and sudorific article.

DIURETICS.

The term *Diuretic* is applied to that class of medicinal agents which possess the power of increasing the urinary secretion, or in other words of exciting into increased activity the functions of the kidneys.

In a general sense, this class embraces a wide range of agents. The urinary secretions may be interrupted from various causes. Thus for example, inflammation of the kidneys will lessen the quantity of urine. By the use of venesection and other antiphlogistic remedies, the inflammation of these organs is subdued and the secretion of urine restored. In a certain sense, therefore, all these agents may be considered as diuretic. It is not, however, in this enlarged way that we shall consider this class of agents, but shall restrict it to those which appear to act directly in promoting the urinary secretion.

Effects.—In analysing these, it is important to distinguish between the effects produced upon the kidneys themselves and those which are produced on other parts of the system.

On the Urinary Organs.—The effects of diuretics are here obvious. They increase the flow of blood to the kidneys, increase the vital action of these organs, and promote their secretory functions. In some cases, active irritation and even inflammation of these organs is the result. Diuretics may then be considered as local stimulants to the kidneys, the degree of stimulation produced by different articles differing [and also, as appears from the researches of Dr. Golding Bird, its character. Some diuretics acting merely as stimulants to the kidneys and increasing the watery portion of the urine, while others seem to stimulate the organ in the performance of its great function of depurating the blood, and increase in a very remarkable manner the quantity of solid matter eliminated in the urine. To the former class belong most of the vegetable diuretics as squills, colchicum, digitalis, all those agents which out of the body produce no chemical effects on animal matter. To the latter belong all the agents which have this power, viz. the alkalies, the alkaline carbonates and the alkaline citrates, tartrates, acetates, &c., these latter being in the system converted into carbonates. If these agents really have the power ascribed to them by Dr. Bird, of increasing the waste of the animal frame, by quickening the process of the metamorphoses of tissues, they can be prescribed in a variety of cases in which diuretics have hereto-

fore either not been given at all or have not been prescribed understandingly.—ED.]

Effects on the Vascular System.—Like all evacuations from the system, the natural effect of an increased flow of urine is to diminish the activity of the circulation. This effect, however, is gradual and usually moderate in degree. As, however, many of the articles are stimulants, the heart and arteries may at first be excited. The effect, therefore, on the circulation, will depend entirely upon the nature of the diuretic agent as well as upon the quantity of urine which may be secreted.

On the *blood* itself some change must also be effected. This must of course vary greatly in consequence of a number of circumstances. If the quantity of watery fluid separated from the blood and discharged by urine be counterbalanced precisely by the quantity taken up by the absorbents from the stomach and bowels, then the blood may remain without much alteration in this respect. Generally, however, this is not the case, and then the blood must vary in the relative proportion of water which it contains. In the saline materials too, contained in the blood, a considerable change takes place; but what the extent of these changes in the circulating fluids is, and what its precise nature, it is not in the present state of our knowledge easy to say. Experiments and observations to elucidate these points would no doubt lead to many important conclusions.

The Skin.—Between the skin and the urinary organs there is an intimate sympathy and one of the most striking and immediate results of an increase in the secretory function of the one is a diminution of that of the other. Hence in all cases where diuresis is long continued, blood flows less freely to the surface—its vital heat is lessened and exhalation is diminished. A striking illustration of these phenomena is witnessed in diabetes. On the other hand where the urinary secretion is impaired, frequently the skin exhales profusely. In cases of suppression of urine, for instance, it has been remarked that there was profuse sweating and that the perspiration had a urinary smell,* and contained urea.

The Exhalant System.—The general effect of continued diuresis is to lessen exhalation throughout the system. As already stated, such is the effect on the external surface of the body. On the *mucous surface*, a similar effect appears to be produced. In Diabetes, this is illustrated in the distressing thirst, hunger, and peculiar sense of emptiness in the stomach, which characterize this complaint.† On the *serous* surfaces, we have no means of ascertaining precisely what effect is produced. The probability, however, is that the same thing occurs here. This may fairly be inferred from the fact, that whenever increased exhalation takes place from serous tissues (constituting dropsies) the urinary secretion is impaired, and

* Mackintosh, vii. p. 269.

† Elliotson.

on the other hand, when the urinary secretion becomes copious, dropsical accumulations lessen and disappear.

On the Absorbent System.—The general opinion of writers is, that diuretics excite very powerfully the action of the absorbents. This was the opinion of Dr. Cullen. Mr. Murray, too, especially insists upon this, and in this way explains their utility in the cure of dropsies. "They discharge," says he, "the watery part of the blood, and by that discharge they indirectly promote absorption. In the case of dropsy, whenever the proportion of the watery part of the blood is diminished by diuretics, the absorbents are quickened into action for the purpose of supplying the deficiency thus created, and in this way they take up the dropsical fluid." Now that dropsical effusions do disappear under the use of diuretics is very certain. Notwithstanding this, the conclusion does not necessarily follow that, therefore, the action of the absorbents is quickened. The dropsical accumulation may disappear, and yet no change whatever take place in the absorbents. It has already been stated, that the general effect of an increased action of the urinary organs is to lessen exhalation. If this be the case, may not diuretics remove dropsical accumulations simply by diminishing exhalation from the surfaces yielding the dropsical fluid, without causing any change in the action of the absorbents? I do not pretend to assert that diuretics do not quicken the absorbents, but it seems to me that this cannot be legitimately deduced from the mere disappearance of dropsical fluids during their use."* The balance between the two is effected, whether by increase of the one or diminution of the other is not certain.

CIRCUMSTANCES MODIFYING THE EFFECTS OF DIURETICS.

Of these there are several which require to be noticed as exercising an important bearing on the practical application of these agents.

1. *Temperature and Season of the Year.*—Whatever has a tendency to check the determination to the skin increases the secretion of the urinary organs. Hence it is, that in cold weather and in cold situations the quantity of urine is always increased, while in warm weather and in warm latitudes the reverse takes place. For the same reason diuretics act more powerfully on the kidneys in cold than in warm weather.

2. *The Quantity and Temperature of the Fluid taken during their use.*—Free dilution aids very materially the effect of diuretics, provided the diluent be cold. If it be warm, instead of determining to the kidneys, it

* Consult on this, Depuy, Manley, Eberle, &c. See also Johnson, v. xxxii. p. 112.

may pass off by the skin. So remarkably does the effect of these agents depend upon the temperature of the diluent, that the same article may frequently be rendered diuretic or diaphoretic, according as the diluent is cold or warm. Spiritus Mindereri, for example, which if taken with warm drinks is diaphoretic, acts as a diuretic, if the drinks be cold and the person be kept cool at the same time. On the other hand, the salt of tartar and nitre are powerful diuretics, yet when taken with warm drinks and the body kept warm they prove sudorific, without acting on the kidneys at all.

3. *The Form in which they are given.*—This exercises a controlling influence on the operation of diuretics, especially the salines, many of which, if given in strong solution, act as purgatives, by causing an endosmosis from the intestines to the saline solution; while if given largely diluted, so that the specific gravity of the fluid is less than 1.026 (that of the blood), they are readily absorbed, and being eliminated by the urine, they act as diuretics.

4. *The Condition of the Skin.*—As already stated, there is a reciprocal relation between the skin and the kidneys. If the excretion from the one be augmented, that from the other is lessened. Hence, if the skin be in a moist state, diuretics produce little effect. For the same reason, if the patient exercises freely during their use, their operation is interfered with.

5. *The Condition of the Bowels.*—There is perhaps no one circumstance which so greatly modifies the effect of this agent as the state of the bowels. Thus, during the use of diuretics, if the bowels become relaxed, the effect on the kidneys will be arrested; of this we have numerous illustrations. Turpentine, which if given in small doses acts powerfully on the urinary organs, loses this property altogether, if given in doses sufficiently large to prove cathartic. Nitre, when given alone, is one of our most decided diuretics, and its presence may be detected in the urine. But if this be combined with some cathartic, it fails in this respect, and it can no longer be detected in the urine. The reason of this is obvious; free watery purging carries off so much of the fluid portion of the blood that there is little left for the kidneys to remove.

6. *The Condition of the System as to Disease.*—In some diseased states, certain diuretics will operate very decidedly, while in the ordinary conditions of the system their power in this way is little or not at all observable. This is particularly the case in dropsy. In this disease, digitalis, for example, exhibits more diuretic powers than under other circumstances.

MODES IN WHICH DIURETICS PROVE CURATIVE.

1st. As local stimulants. In this way they operate when the kidneys

are torpid and inactive; they restore, by their direct stimulation, energy to the organ, and promote the secretion of urine.

2d. By their agency in the removal of dropsical accumulations—this has already been alluded to.

[3d. By their effect in increasing the depurative function of the kidneys—and thus increasing the waste of matter, they may promote the removal of diseased products of low vitality, which often present themselves either in the form of albuminous deposits in the glands, furuncular diseases of the cellular tissues, or incrustations on the skin, as in some of the tuberculous cutaneous diseases.—Ed.]

APPLICATION OF DIURETICS IN THE TREATMENT OF DISEASES.

A few observations will serve to show the extent to which these agents may be applied.

Fevers.—Like every other organ destined to the purposes of secretion, the kidneys are more or less deranged in every case of fever. Hence, not merely the quantity of urine is lessened, but the character of it is changed in various degrees. Now in the management of fever one of the great objects to be accomplished is to restore all the secretions. This holds true no less of the urinary secretion than it does of the others. As a general rule, however, the accomplishment of this object does not require the use of specific diuretics. The condition of the kidneys in fever is consequent upon the morbid states of the sanguineous and nervous system, and the most efficient mode of restoring the urinary secretion is by the use of those remedies which are resorted to for the purpose of subduing general excitement. Except in particular cases, therefore, mere diuretics are not remedies that can be rendered very available.* Among this class of agents, however, there are some which possess other properties which render them frequently beneficial. This is the case with nitre, which is refrigerant as well as diuretic; so also cream of tartar is refrigerant and laxative. These, therefore, may be prescribed with great benefit. As a general rule it may be laid down that only such diuretics are to be used as coöperate with the general indications of cure. As a matter of course this excludes the use of all stimulating and irritating agents.

[One diuretic and that a most certain and efficient one can almost always be used with great advantage. I mean cold water; plentiful dilution with cold water, cold mucilages, or very dilute solutions of salines are very generally both pleasant and useful.—Ed.]

Dropsies.—On the general nature of dropsical disorders I have already

* [The views of G. Bird, before alluded to, tend to modify the opinion here expressed, and to extend the uses of these agents in fever.—Ed.]

said something when speaking of the use of cathartics. In the management of them there is no class of remedies which has been so universally resorted to as diuretics. This has no doubt arisen from the obvious fact that in dropsies the secretion of urine is always more or less impaired, and that when they yield the secretion is generally increased. A leading indication, therefore, has always been to endeavor by every possible means to excite the urinary secretion, and for this purpose diuretics have been extensively used. In the application of this class of agents discrimination however is necessary, and it is to be feared that for the want of this, frequently more harm than good results from their use. As frequently stated before this, dropsies are the mere result of other diseased conditions of the system, and to prescribe remedies for their removal especial regard must be had to the primary disease, as well as to the peculiar symptoms which may present themselves. And with regard to no class of remedies is this more necessary than diuretics, inasmuch as they have been indiscriminately used in almost every form and variety of dropsy.

In some cases dropsy originates from a subacute inflammation of the kidneys terminating in organic disease, characterized by a peculiar granular deposit, and in all cases of this kind the urine is very coagulable by heat. For this important observation in relation to the connexion between coagulable urine and organic disease of the kidneys, we are indebted to Dr. Bright, and since then it has been confirmed by the investigations of Drs. Gregory, Christison, and Osborne. Now when dropsy is connected with this state of the kidneys, diuretics are remedies which so far from doing any good are positively injurious, inasmuch as they are calculated directly to increase the organic disorder of the kidneys. Indeed it appears to be well established that the too free use of diuretic medicines sometimes is the cause of this form of dropsy.

Where dropsy is connected with organic disease of the heart, in consequence of which impediments take place in the circulation through this organ or the kidneys, digitalis may be used with great advantage. And it operates as a diuretic in two ways, by a direct action on the kidneys, but more especially by lessening the inordinate action of the heart, and in this way facilitating the circulation through the capillaries.

In other cases dropsy results from an obstruction of the portal circulation as before stated. Now, in this case, the dropsy is to be combated not by stimulating the kidneys, for their supply of blood is not sufficient to render it possible that they should eliminate a large amount of water—here hydragogue cathartics are proper. But where the disease of the liver interrupts its proper function of secreting bile and eliminating carbon, the kidneys may be stimulated by alkaline secretions, and thus induced to do part at least, of the duty, to the performance of which the liver is no longer competent. Under such circumstances it is that alkalies deserve the name of alteratives, and can be used as such with most manifest advantage.

MODUS OPERANDI OF DIURETICS.

It is to this class of medicines that the advocates of the doctrine that the remote effects of remedies *always* depend on their absorption into the blood, most confidently appeal in support of their hypothesis, and there can be no doubt that the vast majority if not the whole of the diuretics that are in use are absorbed; the only question is in what state are they to be found in the excretions, for it is probable that they exist in that same state in the blood.

[Some diuretics pass into and out of the system without any change; they are found in the urine in the same state in which they were taken into the stomach, such are *nitre*, *carbonate*, and *chlorate of potash*, &c. Others are changed by the reagents they encounter in the alimentary canal, and pass off by the kidneys in a different combination, e. g. tartrate, citrate, and acetate of potash are changed into carbonates. It is not, however, to be supposed that all agents that pass off in the urine unchanged are diuretics, still less that all diuretic agents pass off by that route. This we know is not the fact, and on the other hand, some of our most certain diuretics have not been found in the urine, probably because of our imperfect means of detecting them; the rule generally holding good, that the substances that are usually excreted by any organ stimulate it. There are, moreover, certain agents that prove diuretic by the general impulse they give to the whole system, especially the secreting organs. Of those that act on the whole system the most remarkable are mental impressions; of the latter, those which stimulate the secretory organs in particular, mercury is the example commonly cited.—Ed.]

RULES TO BE OBSERVED DURING THE USE OF DIURETICS.

These may be readily deduced from what has been already stated.

1. Diuretics should be given in a state of solution, and that solution should be so diluted as to have a specific gravity decidedly below that of the cerum of the blood (1.025); that is, they should not contain more than five per cent. of solid matters. If not given in this dilute form, a very free use of water, pure, or containing mucilage, should follow them. This is especially necessary where the alterative effect of the diuretic is desired—where we merely desire to increase the quantity of water it is not so important.

2. During their use, the state of the skin should be attended to, and anything like perspiration avoided. For this purpose, the patient should be kept as much as possible out of bed, and the surrounding temperature be rather low.

3. Be careful that they do not act on the bowels. This will completely

counteract their operation on the urinary organs. For this purpose, where they have any tendency to act on the bowels, they should be given in small and repeated doses instead of large ones. Combining a small quantity of morphia with the diuretic, will often check its purgative tendency probably, by diminishing exhalation from the mucous surface of the intestines. This would undoubtedly favor their proper action.

4. The drinks taken during the use of diuretics should be cold.

INDIVIDUAL DIURETICS.

NITRATE OF POTASH.—This is commonly called *nitre* or *saltpetre*. It is found native or prepared artificially. In its native state it is found effloresced on the surface of the soil in several parts of Europe, Africa, India, and South America. It is also found in several parts of the United States, particularly in some of the middle and western States—generally in caverns or caves in limestone rock. Most of the nitre used in the United States is obtained from the caves of this kind in Kentucky.

It exists also in certain vegetables, such as tobacco, hemlock, &c.

Artificially, it is prepared by mixing up animal and vegetable remains with ashes and calcareous earth. These are placed under sheds open at each end to admit the access of air. They are frequently turned up and moistened with urine, which contains a great quantity of nitrogen. These are what are called *nitre beds*. At the end of a certain time (two or three years) the nitrogen has become converted into nitric acid, and this uniting with the potassa in the vegetable remains, forms *nitrate of potassa*. For the purpose of separating the nitre thus formed from the beds, they are lixiviated. This is performed by pouring boiling water on the mass to dissolve out the nitre. The solution thus obtained, however, contains also nitrates of lime and magnesia. To get rid of these, wood ashes (which contains carbonate of potassa) is added. This decomposes the nitrates of lime and magnesia, and furnishes still more nitrate of potassa, the nitric acid combining with the potassa, while the earthy bases are precipitated. Besides these nitrates, it also contains common salt. This is got rid of by evaporating the solution, when the salt rises to the surface in the form of a scum and is removed. As the solution now cools, the nitre crystallizes in dirty white crystals, and in this state it is called *crude nitre*. It still contains some common salt.

Before this can be used in medicine, it requires to be purified. This is done by boiling it in water, and is founded on the fact that nitre is more soluble in water than salt. The latter which remains undissolved, or is precipitated, is carefully removed. The solution is now clarified by the addition of glue, and then set by to crystallize.

Properties.—Nitre is a white crystalline salt without smell—with a

sharp, bitterish taste, causing a sense of coldness in the mouth and stomach. It contains no water of crystallization. Air does not affect it. It is soluble in four or five times its weight of cold, and two fifths of its weight of boiling water. In alcohol it is insoluble. Exposed to a great heat it fuses; and on cooling, a white opaque mass is formed called the *sal prunelle.* When thrown on burning coals, nitre deflagrates with bright scintillations.

Impurities.—Common salt. Detected by nitrate of silver.

Effects.—These differ according to the quantity in which it is taken. In *moderate doses*, if it be swallowed immediately after it has been dissolved in water, a sensation of coolness is experienced in the fauces, œsophagus, and stomach. After continuing for a few minutes, this is followed by a sense of heat and dryness in the parts where the coolness was felt. According to Jorg, this is accompanied with thirst and an increase of appetite.* On the bowels its operation is uncertain, sometimes causing uneasiness, griping, and evacuations, while at other times it constipates. According to the observations of Jorg, it also increases the exhalation from the skin, although this is by no means a uniform effect. It is on the *urinary organs* that the principal action of nitre is developed.

On these it acts as an excitant, promoting in a remarkable manner the secretion of urine and changing its quality. If the urine be examined while under its use, the presence of the nitre may be readily detected. It is in consequence of this, no doubt, that its prolonged use proves irritative to those organs. For the purpose of ascertaining the effect on the *circulation*, several experiments were instituted by Dr. Alexander, of Edinburgh. In one he took a drachm of nitre dissolved in an ounce of water, his pulse beating at seventy-two in the minute. Two minutes after this, it was reduced to sixty-four; in four minutes after to sixty-two. From this time it began to increase, till at the end of ten minutes it was at seventy, and soon after at seventy-two, where it remained. In about one hour after he repeated the same dose, his pulse beating seventy in a minute. In one minute after it was reduced to sixty. It soon rose, however, and in ten minutes beat sixty-eight, and in a few minutes more seventy.† Other experiments of a similar nature were made, and with a like result. In all the pulse fell shortly after swallowing it, but in about ten minutes rose again to its original standard. From the peculiar manner in which the pulse was affected in these cases, he was induced to believe that the sudden sinking of it was entirely owing to the impression of the cold fluid upon the stomach. In corroboration of this, he found that large draughts of simple cold water hastily swallowed, always lessened the number of pulsations in a minute, three, four, five, sometimes more beats.‡ It would

* American Jour. v. x. p. 143.

† Experimental Essays, by W. Alexander, p. 104, 5.

‡ P. 122.

seem that diminution of the pulse is produced only in consequence of the sudden impression of the cold mixture on the stomach sympathetically impairing the action of the heart, and not to any specific operation of the nitre. During the use of nitre, the *blood* itself appears to undergo some change. Barbier states that in a person who took half an ounce in the course of four days, the venous blood assumed a singularly lively red appearance.*

By some writers nitre is supposed to be *refrigerant*, and so it would seem to be, if any inference can be drawn from the sensation of cold produced after swallowing it, as well as from the depression of pulse which it occasions. By Dr. Alexander, however, it was ascertained that a thermometer placed on the pit of the stomach was not affected during its use, and he lays it down as proved, that "whatever power nitre might have of cooling the body, it does not exert it in any perceptible manner on its external parts."†

In *large doses*, as one or two ounces, it acts as an irritant poison, causing pain in the stomach and bowels, vomiting, purging, with bloody discharges, followed by vertigo, delirium, and death. On dissection the stomach and bowels are found inflamed.

Extent to which Nitre may be taken.—On this subject some interesting experiments were made by Dr. Alexander, the result of which was, that it might be taken with perfect safety in much larger doses than are commonly prescribed. By him, ʒ iss dissolved in ℥ iij of water, and suffered to stand for twelve hours, was taken at a dose without any inconvenience, and ℥ iss dissolved in three pounds of water was taken in twenty-four hours, a draught each hour, without any unpleasant effects.‡ A remarkable difference, however, was observed in the effects according as it was swallowed immediately after it was dissolved, or after it had been suffered to stand for a few hours. When each dose was taken as soon as it was dissolved, not more than half the quantity could be borne without unpleasant consequences.§ Dr. Alexander states that in a number of inflammatory cases, he gave it to the extent of ℈ ij every hour, or every hour and a half, every dose being newly dissolved. "In this way," he says, "I have generally seen it sit very easy on the stomach; often procure great remission of the symptoms; and almost always work off by a plentiful discharge of sweat or urine, according as the patient took along with it warm or cold drink."‖ By Dr. Brockelsby, it was also used in large doses; ʒ x in twenty-four hours with great advantage.

Mode of Administration.—The ordinary dose for an adult is from 10 to 20 or 30 grs. repeated every two or three hours. This may be given in water or some mucilaginous fluid; where the object is to produce its

* Vol. iii. p. 569. See also Stevens's Exps. on this. † P. 105.
‡ P. 111–113. § P. 115. ‖ P. 117.

refrigerant effect it should be taken in cold water and swallowed as soon as dissolved. [This is one of the salts of which large dilution is most important. Large doses (℥i to ℥iss in a day) of nitrate have been of late used with great success in cases of rheumatism. It often produces very free diuresis and increases the quantity of solid matter in the urine.—Ed.]

Cream of Tartar.—This salt has been already described under the head of cathartics; it is also refrigerant and diuretic. If long continued, debilitating in its operation, causing general emaciation.

The best mode of using it is— ʒij dissolved in a quart of water, to be taken during the day, sweetened with sugar. A weaker solution would probably prove still more certainly diuretic.

Acetate of Potash—Sal Diureticus.—This is prepared by saturating diluted acetic acid with carbonate of potash and then evaporating. It is a colorless salt with a pungent saline taste, exceedingly deliquescent; when exposed to the air it is changed into a liquid of an oleaginous appearance; soluble in half its weight of water and twice its weight of alcohol.

In small doses *diuretic* and in larger ones *cathartic*. As a diuretic the dose is from ℈j to ʒi; cathartic ʒij to ʒiij—given in solution, varying in strength according as one or the other effect is desired.

Spiritus nitri dulcis, also called *Spiritus etheris nitrosi*, *spiritus etheris nitrici*, *spirit of nitric ether*, *sweet spirits of nitre*.—It is made by the action of alcohol upon nitric acid and then distilling. It is a colorless liquid, has a fragrant odor and a slightly sweetish and acidulous taste. Its specific gravity should not exceed 0.834. It is inflammable and very volatile. It is soluble both in water and alcohol; when added to the tincture of guaiac it has the singular property of producing a deep blue color.

Effects on the System.—Spirits of nitre acts decidedly upon the kidneys and promotes very considerably the flow of urine. It is also refrigerant and somewhat antispasmodic. It is therefore an exceedingly useful article when you wish to allay thirst, moderate heat, and promote the urinary secretion. It is grateful to the stomach, relieving nausea and flatulency.

Dose.—It may be given in doses of from 30 to 60 drops repeated every three or four hours or oftener. [A few drops taken in parsley tea is an excellent diuretic for infants.—Ed.]

Digitalis purpurea.—This is the *Foxglove*, a beautiful biennial plant found native in various parts of Europe. In Great Britain it is indigenous, and in the north of England it grows abundantly and presents a magnificent appearance about the hills and the borders of fields. It is generally found in dry and sandy soils. In the United States it is also found in abun-

dance but is not indigenous. It is cultivated here for the beauty of its flowers and for medicinal purposes. In the East Indies it is also cultivated. Mr. Ainslie states that he saw it growing in the botanical garden at Bangalore, although the plant was not robust.* It has a knotty fibrous (perennial) root, which sends up a stem about four feet high. Its flowers are numerous and beautiful. They are large and of a bell form. From their resemblance to the finger of a glove, the name digitalis is supposed to be derived. They are of a bright purple color, sprinkled with eye-like spots. The parts used in medicine are the *leaves.*

Physical Characters of the Leaves.—The leaves of the digitalis differ from one another in size and shape. The lower ones are egg-shaped and about eight inches long and three in breadth. Both are slightly serrated and have wrinkled surfaces, the upper of a dark green color and the under pale and downy. While fresh they have no smell, but on being dried they acquire a slight narcotic odor. Their taste is bitter and nauseous. Their powder is of a beautiful deep green color.

Chemical Composition and Properties.—Digitalis imparts its active properties both to water and alcohol. Its active principle has been isolated as a crystalline resinous matter, bitter, acrid, soluble in alcohol and sparingly so in water and ether. It has not been used in medicine.

Physiological Effects.—These vary very greatly with the dose in which it is given, and the length of time it is continued.

When given in very *small doses*, it does not produce any very marked effect on the system.

Given in doses sufficient to bring the system under its influence it operates first as an excitant, and afterwards as a sedative. The primary effects are a sense of weight in the head, vertigo, headache, increased heat of surface, and obscured vision. Along with these, there is a sense of heat and itching in the pharynx and œsophagus, extending sometimes to the larynx and trachea. The stomach becomes affected with nausea, and purging sometimes takes place. The kidneys are excited, and an increased secretion of urine results. According to Jorg, too, the genital organs are excited, and "in the female, symptoms identical with those which precede the menstrual flux" are produced. On the pulse the primary effect is to increase its force and frequency. On this point there has been much difference of opinion, it being contended by some that digitalis acts primarily as a sedative upon the circulation. That such, however, is not the case is proved by abundant observations. So long ago as the year 1800, a series of experiments were made by Dr. John Moore, which conclusively establish this point. From one and a half to four grains of digitalis were taken by himself and others, and as a general result, the pulse increased in force and frequency during from half an hour to an hour.

* Ainslie, Mat. Med. pref. p. 21.

The primary stimulant effect thus produced is succeeded by a sedative influence, and this is manifested more especially in the circulation. After the stimulant action has passed off, both the force and frequency of the pulse become lessened frequently in a most remarkable manner.

This is especially observed when the use of the digitalis has been continued for a certain length of time. Under these circumstances, the pulse frequently comes down from 100 and upwards in a minute, to 80, 70, and even 40 and 30 in a minute, and this effect continues for several days, and even weeks. With regard to the effect on the circulation, there is a circumstance which has been noticed, which is of practical interest, and this is that it varies with the position of the patient. Although observed previously, Dr. Baildon has the credit of first noting this curious fact. He observed it in his own case while taking the medicine for what he supposed to be pulmonary consumption. After the digitalis had produced its full effect on his system, as indicated by the reduction of the pulse to about 40 beats in a minute, he found that "his pulse was not lessened in frequency when he stood erect; it was then upwards of 100. When he sat down it fell considerably; when lying on his back it fell much more. Thus, during the time it was at 40 when lying, it was about 75 when sitting, and above 100 when standing. This was invariably the case." The same fact he observed in patients to whom he gave it to any extent. The necessity of attending to this circumstance in the use of this drug is self-evident.

With regard to the effect of digitalis on the urinary organs, the general opinion appears to have been that it shows its power as a diuretic only in cases of dropsy, while in the ordinary condition of the system it produces no such effect. Assuming this as a fact, the diuretic operation of digitalis has been explained upon the principle of its primarily exciting the action of the absorbents, in consequence of which the effused fluid is carried into the circulation, from whence it is afterwards separated by the secreting action of the kidneys. Although there can be no doubt that the diuretic action of digitalis is most strikingly developed in dropsical cases, yet the experiments of Jorg already alluded to, establish the fact that it does operate directly as a diuretic in health.

With regard to the foregoing effects there is this peculiarity: that they are not limited to the period during which the article is used, but continue for three, four, and five days and even longer after its use is relinquished. Dr. Baildon states, that when he took digitalis in his own case for phthisis, after his pulse sank to 36 he discontinued its use, but that it took nearly one month before it returned to its natural standard, 72. So also the increased secretion of urine will be continued for several days after the medicine is stopped. In relation to the sickness at stomach which it produces it frequently does not come on until some time after the exhibition of the medicine has been discontinued. After ceasing, too, "it will recur as violently as before, and will continue by repeated attacks in

this manner for three or four days, at distant and more distant intervals."*

In *large doses*, or if its use be continued too long even in ordinary doses, digitalis produces the effect of a narcotico-acrid poison. When long continued, it sometimes accumulates in the system and eventually gives rise, rather suddenly, to vertigo, impaired vision, nausea, salivation, vomiting and sometimes purging, copious perspiration and very free diuresis, accompanied with great prostration and sinking of the pulse. If the symptoms are not relieved, general prostration, convulsions, and death result.

From the foregoing, then, it appears that digitalis in its primary operation is exciting, while its secondary action is sedative, and that it developes its principal powers upon the circulation and upon the urinary organs. The proper indications for its use are those conditions of the system in which it is desirable to impair the action of the heart or to excite powerfully the urinary secretion.

Circumstances Modifying the Effects of Digitalis.—As the result of observation and experience, it has been ascertained that the activity of digitalis is a good deal modified by a variety of circumstances, such as the mode in which the plant grows—the season of the year when the leaves are gathered—the part of the leaf that is used—the manner in which it is dried and the length of time it is kept. By some it has been supposed that the virtue of the digitalis became deteriorated by cultivation. By Dr. Hamilton, however, the contrary is asserted, and he states as the result of observation that when carefully cultivated in gardens where there is a free exposure to the air, it yields a larger and more vigorous leaf than it does in shaded lanes and hedge rows where it is found growing spontaneously.† The season of the year when the leaf is gathered is of still greater importance. It is well known that in vegetables the strength of particular parts varies with the season, depending upon the evolution and rising of the sap. In the spring before the sap has ascended, the principal power is in the root, and it is not until some time afterwards that this power is imparted to the leaves. Different seasons, therefore, are appropriated to gathering, according to the part of the plant which may be used. In the present case the proper period, according to Dr. Withering, is "about the time the flowering stem has shot up, and when the blossoms are coming forth." It is then that the leaf possesses the greatest strength. Not unfrequently by those who deal in this article, this rule is altogether disregarded, and the leaves are gathered very late in the summer or in the autumn. The difference in power and effect may easily be imagined. By Dr. Withering, who

* Duncan's Med. Com., vol. v. p. 371.

† Observations on the Preparation, Utility, and Administration of the Digitalis. Prepared by Wm. Hamilton, M. D., p. 78.

studied and understood the genius of this vegetable more thoroughly than any other person, the small leaves are considered more powerful than the large, and he directs only the leafy part to be used—the stalk and mid-rib being rejected. In drying the leaves for preservation great care is also to be exercised. They should be dried separately in the air or in a tin pan before the fire with a heat just sufficient to allow of their reduction to powder. If it be possible, too, it should be done with the exclusion of light. Both light and great heat have a tendency to dissipate their virtues. After drying they should be kept in opaque vessels, secluded from light and moisture, or they may be pulverized and kept in the same kind of vessels. As it may be impaired by keeping, the best plan is to have it fresh every year.

PRACTICAL APPLICATION.

1. *Inflammation.*—From the very decided effect which digitalis has in lowering the force and frequency of the pulse it was very natural to suppose that it might prove exceedingly advantageous as a remedy in controlling inflammatory action. Experience, however, has satisfactorily established the fact that in the primary stages of inflammation it is not to be depended upon. After suitable depletion it may prove a useful auxiliary by quieting the irritation of the heart.

2. *Hemorrhages.*—Here too much was expected from digitalis, but experience has proved that the remedy, though not without power, is not adequate to the control of active hemorrhage, and, as has been suggested by Mr. Brodie, its use is not without danger.

3. *Pulmonary Consumption.*—So great were the advantages supposed at one time to result from the use of digitalis in pulmonary consumption that its ardent advocates were ready to proclaim it a specific for that formidable disease. Time has dissipated this fond anticipation, and proved that though digitalis will do something in this complaint, it falls far short of being a specific. To moderate the action of the heart, and diminish the general irritability of the system, may alleviate the unpleasant symptoms of tuberculous deposit in the lungs. This is all that digitalis can do.

4. *Dropsy.*—In this disease digitalis has been more celebrated than any other, and it is no doubt a remedy of great value. It is not appropriate to every form of the disease, nor to every state and condition of the system. As a general rule it will succeed best in asthenic rather than sthenic dropsies; but its best powers in dropsy are manifested in those cases where the effusion is consequent on organic disease of the heart; here by quieting the circulation it diminishes exhalation, while by its stimulating effect on the kidneys it removes the fluid.

Diseases of the Heart and great vessels.—In many of these affections a

great deal can be done by the steady use of digitalis. It moderates the force of circulation, and thus probably delays the progress of aneurisms in very many cases, while in a few by favoring coagulation of the blood in the sac it may promote a cure. In very many functional disorders of the heart digitalis will, by moderating the force of the circulation, afford temporary if not permanent relief.

Modes of Administration.—The forms in which digitalis may be used are the following:

1. *Substance.*—In this state it may be given either in *pill* or *powder;* the dose to begin with may be from gr. ss to gr. j twice a day to be increased gradually by the addition of $\frac{1}{4}$ of a gr. a day, or the original dose to be repeated at shorter intervals, say of six or eight hours. In using the digitalis in substance, great care should be taken to see that it has the green color and the peculiar smell of the fresh plant; unless this is done there is no certainty at all in its operation.

2. *Infusion.*—This is a more common form of using it than the substance, and it is prepared by infusing ʒj of the dried leaves for four hours in half a pint of boiling water. To this when strained ℥j of any aromatic spirit is to be added to preserve it from spoiling. Of this from ℥ss to ℥j may be taken twice a day. In this form it has generally been supposed that the digitalis operates more powerfully and successfully as a *diuretic*, and it is accordingly in this way that it has been customary to prescribe it when administered in dropsical affections.

3. *Tincture.*—Of all the preparations this for general use is the most valuable. It is the form in which it is generally prescribed when you wish to produce the specific effect of the article on the circulation. As a diuretic it is inferior to the other preparations, especially the infusion. The dose of the tincture to begin with, is from ten to twenty drops twice a day, to be increased gradually a drop or two a day until the desired effect on the pulse is produced.

RULES TO BE OBSERVED IN THE USE OF THIS ARTICLE.

From the very powerful and peculiar effects which digitalis produces on the system, too much caution cannot be observed in its exhibition. For the purpose of guiding you a little on this subject the following rules may be observed.

1. See that the article is really what it professes to be and ascertain as far as you can the strength of the preparation, whether it is in the form of powder or tincture. From what has been already stated in relation to the variable strength of the leaf, the necessity of this precaution is perfectly obvious.

With regard to the *tincture*, there is still another precaution necessary.

Not unfrequently in apothecaries' shops, it is customary to leave tinctures upon the dregs, and gradually pour off the clear part for use—"the dregs are afterwards pressed out, and the last portion of tincture acquires, by this careless proceeding, double the strength of the first." In this way accidents of a serious nature have sometimes occurred. Mr. Brande relates an interesting case of a person laboring under hydrothorax who was in the habit of taking forty drops of the tincture of digitalis every night on going to bed. Being in the country without his medicine he was obliged to send to an apothecary there for some of it, and of this he took the usual quantity. The effect, however, was vastly different, for by the morning he was dead. From the symptoms it was suspected to be owing to the medicine, and on inquiry it was found that the tincture had been kept standing on the leaves so long that at the time it was sold, it had evaporated so much as to render it necessary to shake out the leaves and squeeze them to obtain the necessary quantity. In this case the strength of the article was so greatly increased as to leave no doubt that the patient died from the effects of the medicine and not from disease.

2. As the effects of digitalis are obtained not from a single dose, but from repeated doses, and as these effects are apt to be violent and even dangerous if the use of the remedy be carried beyond a certain limit, it is essential in all cases to observe very carefully and repeatedly the state of the patient while the medicine is administered. As soon as any effect is produced on the pulse, its use is to be intermitted. By Dr. Withering the rule is laid down that it should be continued until "it either acts upon the kidneys, the stomach, the pulse, or the bowels; but let it be stopped on the first appearance of any of these effects." The pulse should accordingly be incessantly examined to enable you to judge of the manner and extent of its action. The reason for the necessity of stopping the remedy as soon as its effects begin to appear, is, that they appear to accumulate in the system, and that there is no proportion between them and the individual doses which may be administered.

3. Another precaution necessary in using it is founded on the fact that though in persons who continue taking digitalis for any length of time, larger and larger doses may be taken with impunity, resembling, in this respect, opium; yet, if the use of it be suspended for any length of time the effect of habit wears off and the system loses this power of bearing such large quantities. If given, therefore, under these circumstances, serious and even dangerous consequences may arise. As a prudential measure, therefore, you are always to commence again with moderate doses.

4. Dangerous prostration has sometimes followed a sudden rising from the chair or bed. Let your patient be cautioned against the sudden assuming of the erect posture.

[5. With all the precautions that can be taken it is a very dangerous

as well as a very uncertain remedy. It proved fatal in one case, in the hands of the most prudent and one of the most skilful physicians I ever knew.—Ed.]

Scilla Maritima.—This has already been noticed under the head of emetics. As a *diuretic*, it is still more valuable. To obtain its full effect in this way it is necessary, however, to give it to a certain extent. Taken in certain quantities, this article causes nausea, vomiting, and purging. By Dr. Home of Edinburgh, it was maintained that the production of actual vomiting was necessary to secure the full diuretic operation of it, and he relates several cases of dropsy which seem to support this view. (Exps.) Others contend that vomiting interferes with its subsequent action as a diuretic. Whether actual vomiting be necessary or not, one thing is certain that some impression ought to be made on the stomach in the way of nausea, before its full effect will be obtained. The rule laid down by Dr. Blackall, and this perhaps is the best, is to carry it to the fullest extent which the patient can bear without causing sickness. To get at this point the plan is to begin with small doses, gradually increasing them until either a suitable diuretic effect is procured, or until slight nausea is brought on. A little less than this is then to be continued, until the desired effect is produced. In its general effect on the system, squill is usually considered stimulating. Notwithstanding this, it is observed that when the system is under its full influence, especially if nausea and vomiting be present, the pulse is rendered much slower. This is particularly remarked by Dr. Home. (P. 403.) In some cases the pulse was reduced as low as 40.

Mode of Administration.—Substances.—Most usually in the form of pill; from 1 to 3 grs., two or three times a day; frequently combined with calomel.

Vinegar.—This is the better form, inasmuch as the dose can be gradually increased. Of this about 30 drops three times a day may be commenced with—increased to 50 or till nausea is produced.

Used in dropsies in which the urine is not coagulable or where the inflammatory diathesis is not present.

Convolvulus Panduratus (*the wild potatoe.*)—An indigenous plant with a climbing stem, growing ten or twelve feet long. The active part of the plant is the *root.* This is very large—about three inches thick, and two or three feet long, branched at the bottom—externally, of a yellowish color—internally, whitish and milky, with somewhat of an acrid taste.

Effects.—Diuretic and cathartic. In powder it purges, but does not act as a diuretic. In infusion, according to Dr. McLean, it is one of the best diuretics we have. He recommends it to be made by adding an ounce of the root cut into small pieces to a pint of boiling water. Of this, the dose

is ℥ ss. every two hours; the addition of juniper berries increases the effect. It does not stimulate the system, and sits well on the stomach. This is very popular in some parts of the country in many complaints.

Juniperus Communis.—This is the common juniper, a low, branching evergreen, growing on heaths and hills. It is a native of Europe, but naturalized in this country. It grows about six or seven feet high, and if properly cultivated, fourteen or fifteen feet. The parts used in medicine are the *berries* and *tops*—principally the berries. The *berries* are about the size of common currants, and purplish black in color; they have a peculiar aromatic terebinthinate odor, and a warm, sweetish taste, followed by bitterness. The best kind are imported into this country from the Mediterranean. The berries produced in this country, although equal in appearance, are very inferior to the foreign, and are not much used.—U. S. Disp.

Composition.—*Volatile oil*, 1.00; *wax*, 4.00; *resin*, 10.00; peculiar *kind of sugar*, with acetate and malate of lime, 30.80; *gum*, 7.00; *lignin*, 35.00; *water*, 12.90.

Both alcohol and water extract the virtues of the berries. The active properties of this article depend upon the volatile oil, which is obtained by distillation.

Effects.—Acts decidedly on the urinary organs, promotes the secretion of urine, and imparts to that fluid the odor of violets. To the bladder, it proves stimulant and tonic, exerting a special influence over its muscular and mucous tissues. Hence, in debilitated states of that organ, it sometimes restrains secretion and augments its contractile powers. Upon this principle it has been found useful in catarrh of the bladder, &c., and in some cases small calculi have been expelled during its use.

If given in large doses, it causes great irritation of the urinary organs.

On the system at large, the general effects of this article are stimulating; cordial to the stomach; it excites the circulation, and quickens the functions generally.

Form of Administration.—The common form is that of *infusion.* ℥ j of bruised berries to a pint of boiling water—dose ℥ iij to ℥ iv. every four hours.

Oil of Juniper.—Obtained by subjecting the fruit to distillation with water. Limpid, transparent, nearly colorless, lighter than water, and has the odor and taste of the fruit.

This is one of the most powerful diuretics we have. Dose, from two to six drops mixed with sugar and mucilage.

Christison says that five minims of the oil with ℥ j of sweet sp. of nitre, three times a day in any common vehicle, produced diuresis in dropsy where other means had failed.

Apocynum Cannabinum (*Indian hemp.*)—An indigenous herbaceous

plant, growing in every part of the United States. It grows two or three feet high, with a horizontal root five or six feet long. Both the stem and root, when fresh, abound in a milky juice. The bark of the stem is tough and fibrous, and can be peeled off in strings. By the Indians it is used as a substitute for hemp, in making their bags and fishing nets, &c., and from this the common name of *Indian hemp* is derived. The only part used in medicine is the *root.*

The *root* is from five to six feet long, and about one third of an inch thick. It is composed of two parts, a cortical, brown and rough without, and white and smooth within; and a ligneous part, which is a cord of a yellowish white color. Its taste bitter and nauseous, odor strong and unpleasant. When dried, the root is brittle and readily pulverized, yielding a powder very much like that of ipecacuanha.

Composition.—According to Dr. Griscom, it contains a peculiar bitter principle, *apocynin*, tannin, an acid (probably the gallic), gum, resin, wax, fecula, coloring matter, and lignin. Both water and alcohol extract its virtues. According to Griscom, water does it to a greater extent than alcohol. The cortical part yields a much larger proportion of active ingredients than the ligneous.

Effects.—Resembles in many respects colchicum. In moderate doses, promotes the secretions of the mucous membrane, acting as an alterative and expectorant. In large doses it causes nausea, vomiting, and free purging. Along with these, it lowers the frequency of the pulse, and increases the secretions from the skin and kidneys. Like many other diuretics, it is by no means certain in its action on the kidneys; in some cases producing a free evacuation of urine, while in others little or no effect of this kind is produced. In its action on the bowels it is powerfully hydragogue. The *powder* applied to the nostrils acts as a sternutatory.

Mode of Administration. Substance.—Fifteen grains prove emetic, and operate very much like ipecac. If the dose be large, it vomits and purges.

Decoction. This is the best form, ℥ ij. of the dried root boiled in three pints of water down to two pints; of this ℥ j. to ℥ ij. three times a day, or oftener.

Used, principally in dropsy. The juice of the root or plant is used as a local application in cutaneous affections.

Colchicum autumnale.—Of this I shall speak at large when I come to treat of sedatives.

Turpentine.—This has already been noticed under the head of anthelmintics. In large doses, it acts speedily and powerfully on the intestines, and in this way is used for the purpose of evacuating the tape worm. Given in small doses, it affects not the bowels, but the urinary organs, exciting them to increased action and promoting the flow of urine; occa-

sionally it causes a good deal of irritation, sometimes strangury and suppression of urine. Most generally, however, it merely increases the flow of urine. Under its use, the fluid always acquires the peculiar smell of violets. So decided is the affinity of this substance for the urinary organs, that even breathing the vapor of it for a short time imparts the same odor to the urine. In its general operations on the system, this article is *stimulating*. Given in doses of fifteen to thirty grains, it quickens the pulse, increases animal heat, and causes some degree of exhilaration. As a diuretic, therefore, its use is to be limited to those cases in which a stimulant is indicated.

Besides increasing the flow of urine, "it is said to possess the remarkable property of increasing the lithic acid in it, and it certainly appears at times to bring on lithiasis in those whose fits of gravel are habitually carried off by copious discharges of lithic acid and lithate of ammonia."—Christison, p. 922.

Although acting on the urinary organs, turpentine is not a very reliable diuretic.

Form, &c.—Ten to twenty or thirty drops, diffused in water with mucilage and sugar.

Cantharides.—A full account of this article will be given under the head of Epispastics. It is sometimes used internally, and its effects differ greatly according to the quantity in which it is taken.

In *moderate doses*, it acts as a gentle stimulant to the alimentary canal, and speedily produces a sense of irritation in the urethra, accompanied with an increased desire to pass urine. In some cases, the quantity of urine is increased, while in others this is not the case. Although, therefore, it acts decidedly on the urinary organs, it is not uniform in its operation as a diuretic.

In *large doses*, it produces great irritation of the urinary organs, causing all the symptoms of strangury. There is pain and burning in the bladder, with constant desire to pass urine. The secretion of that fluid, instead of being increased, is diminished, while the inflammation of the neck of the bladder and urethra causes a constant desire to pass it. In these organs, a state of things is brought about analogous to that which exists in the intestines, in cases of dysentery. Along with all this, there is general feverish excitement of the system.

In *still larger* doses, it acts as an irritating poison.

According, therefore, to the manner in which it is used, cantharides may be made to produce the effects of a mild stimulant or of a powerful irritant to the urinary organs. Upon the general system, it acts as a stimulant.

Form and Dose.—Pill i to ij grs. *Tincture*, ten to sixty drops in barley water or gum water.

A very free use of diluents is essential, while using this article, both to render its diuretic operation more certain, and to prevent strangury.

Copaiba.—This is the product of different species of the Copaifera, a genus of plants growing in the warm regions of South America. The *Copaifera officinalis* is a lofty tree growing in Venezuela and some parts of the West Indies. The greater part of the copaiba of commerce, however, is obtained from the *Copaifera multijuga*, a native of the province of Para, in the Brazils.

The balsam is obtained by boring or wounding the tree to the pith near the base of the trunk, whence it flows so freely that twelve pounds have frequently been collected in three hours. When it first flows, it is a clear, thin, colorless fluid; but by being kept, it acquires a yellowish color, and becomes thickened.

Balsam of Copaiba is clear and transparent, of the consistency of olive oil, and of a pale golden color. It has a peculiar and fragrant odor, and an acrid, bitterish taste. It is lighter than water. When exposed with an extended surface to the action of the atmosphere, it gradually thickens, until at length it becomes solid, dry, and brittle, like resin. When triturated with $\frac{1}{16}$ magnesia, it gradually becomes solid.

When copaiba becomes very old, it is susceptible of crystallization. Pelletier has seen it thirty years old; the resinous crystals had the property of polarizing light. By long keeping, its virtues are impaired; the fresher the better. In *water* it is insoluble; in alcohol, ether, and the fixed and volatile oils perfectly soluble.

Chemical Composition.—Copaiba consists of *volatile oil* and *resin.* According to the analysis of Stoltze, 100 parts contained of *volatile oil*, 38 parts; *yellow hard resin* (copaivic acid), 52.75; *brown soft resin*, 1.66; *water and loss*, 7·59. The active part is the *oil.*

After copaiba has been deprived of its volatile oil, by distillation, a brownish resinous mass is left. This is sold as the *resin of copaiva.* It consists of the two resins before mentioned, which may be separated by rectified spirit. This dissolves the acid resin (copaivic acid), but leaves the viscid one.—(Pereira.)

As copaiba does not contain benzoic acid, it is not a *balsam.*

Purity.—According to Dr. Paris, a great deal of the copaiba used in London is factitious; and he states that a trial took place between the owner of certain premises that were burnt down and the governors of the Sun Fire Office, in consequence of the latter refusing to indemnify the proprietor for his loss, because the fire had been occasioned by his *making* balsam of copaiba.—P. 345.

The articles with which it is sometimes adulterated are *common oil*, *Venice turpentine*, and *castor oil.* Of these, the most difficult of detection

is castor oil, from the fact of its being soluble in alcohol as well as the balsam, which the other oils are not.

To detect the presence of *castor oil*, the following tests may be resorted to.

1. *Boil one drachm of the copaiba in a pint of water till the liquid is entirely evaporated.* If the copaiba be pure, a hard resinous mass is left behind. If it contain castor oil, it will be more or less *soft*, according to the quantity of oil present.

2. *Shake together in a bottle one part of aq. ammoniæ with two and a half of copaiba.*—If the copaiba be pure the mixture will speedily become clear and transparent; if it contain castor oil it will remain more or less opaque.—U. S. Dis.

The presence of *turpentine* may be detected by the odor, when heated. A simple way of doing this is to drop a little of the suspected article on a heated spatula.

The presence of *common oils* may be detected by the action of alcohol. Pure balsam is soluble in about four parts of alcohol—common oils are not.

It is sometimes mixed with *rape oil.* In this case if dropped into water it will not preserve its spherical form on the surface as it will if pure. —Paris, 345.

Effects.—Copaiba is a local and general stimulant. When taken into the stomach it creates a sense of warmth, which is followed frequently by a general disturbance of that organ. Eructations charged with the balsam take place accompanied with nausea, loss of appetite, and sometimes vomiting. These effects frequently are so disagreeable as to prevent the continuance of it. The constitutional effect of the copaiba is principally developed in its action on the mucous membranes and more especially on the urinary organs. It excites the kidneys, increases the flow of urine, and at the same time exerts a peculiar influence over the mucous lining of the bladder, and more especially of the urethra. To the urine it imparts a bitter taste and a peculiar balsamic smell, different from the violet smell produced by the turpentine.

When given in too *large doses* this article irritates and disorders the stomach, causing heat, pain, nausea, vomiting, purging, and pain of the bowels. The general system too becomes excited, producing heat of skin and fever; sometimes the nervous system is peculiarly affected, producing, according to Armstrong, "a sort of vibratory feeling in the brain, or causing a febrile anxiety, with a mental disturbance bordering on delirium." Another curious effect sometimes follows its too free use, and that is an eruption somewhat resembling the nettle rash. This more commonly occurs where the stomach has been disordered by it, though it sometimes occurs without this. In some cases "hematuria and ischuria are brought on by it."—Pereira, p. 1176.

Mode of Administration.—As the taste of this article is exceedingly

disagreeable the form in which it is given is a matter of great importance, inasmuch as it frequently depends upon this whether it can be taken at all. The simplest and best form of giving it, if it can be taken, is to drop it on sugar.

Another mode is to give it floating on water with the addition of a little bitter tincture to cover the taste.

None of these answer so well, however, as to incorporate it with mucilage, with the addition of other ingredients to cover the taste. The following is one of the best prescriptions of this kind.

℞. Balsam Copaibæ
Spirit. Nitrici Ætheris āā ℥ j
Pulv. Gum. Arabic.
——Sacchar. Alb. āā ʒ ij
Spirit Lavand. C. ℥ ss
Tinct. Thebaic. ʒ ij
Aq. Font. ℥ viij M.

Of this give a tablespoonful three times a day. The average dose, in whatever way taken, is from 15 to 30 drops three times a day.

Recently another mode of giving copaiba has been introduced and that is in the form of *gelatine capsules*. They are made of a compound of gelatine, gum, and sugar; with this the distended and greased bladder of the tench (or other small fish) is coated and afterwards the air and membranous mould are withdrawn. (Pereira, p. 1179.) Each of these capsules contains about 10 drops of copaiba, and the object is to cover the taste and smell of it. When they get into the stomach the capsule dissolves and the balsam escapes. When made into pills with magnesia the masses not unfrequently pass from the bowels unchanged.

Oleum Copaibæ.—The volatile oil is the active part of the copaiba, the resin being almost entirely inert. It is obtained by distillation from the balsam. As first obtained it is of a beautiful green color. By redistillation it is colorless. When perfectly pure it is limpid and colorless; volatile and inflammable, with an acrid taste, and a peculiar aromatic odor.

This possesses all the active properties of balsam and has recently been introduced into practice. The dose is from 10 to 20 drops taken on sugar, or made into an emulsion.

℞. Ol. Copaibæ ʒ ij
Gum. Arabic. ℥ ss
Aq. Cinnamom. ℥ ij
Syrup. Simp. ℥ iss
Tinct. Theb. ʒ ss

Tablespoonful three or four times a day.

Diseases in which the Copaiba is used.—Copaiba is almost exclusively used in mucous inflammations, especially gonorrhœa, for which it has long

been *the remedy.* It used to be given only when the disease had passed into the chronic stage, but now is often used and with success very early. The free use of saline purgatives combined with plentiful dilution will prepare the system for copaiba in a single day. It should be given in full doses for three or four days and then in smaller for about a week. Copaiba is also used by some practitioners in chronic catarrh of the bladder. In old cases of bronchitis it has also some reputation, and may be used in leucorrhœa with prospect of advantage.

Cubebs.—The plant which yields this is the *Piper cubeba*, a species of pepper growing native in Java, New Guinea, and the Isle of France. It is a climbing perennial plant. The fruit is a *berry* which grows in clusters. It is this part dried which is used in medicine. In their appearance cubebs resemble the common black pepper, with the exception of being lighter colored and having small stalks attached to them. Within the cortical part, which is hard, there is a single loose round seed, with a black coat—whitish and oleaginous within. The berries have an agreeable and fragrant *odor.* When chewed they have a pungent, aromatic, and slightly bitter taste, leaving a sensation of coolness on the tongue resembling that which is produced by peppermint. The powder is of a dark color and has an oily appearance.

Composition.—According to Vauquelin, cubebs contains, 1. *A volatile oil.* 2. *A resin resembling that of copaiba.* 3. *A small quantity of another colored resin.* 4. *A colored gummy matter.* 5. *Extractive.* 6. *Saline substances.*

According to Thomson the volatile oil resides chiefly in the nucleus.

It is important to recollect that when pulverized the cubebs part very readily with the volatile oil, and their active properties are greatly impaired. To obviate this the best plan is to keep them in the state of berry—or if pulverized in bottles closely stopped.

Purity. 1. In the form of berry, according to Dr. Paris, it is frequently mixed with "Turkey yellow berries," the dried fruit of the Rhamnus catharticus (common buckthorn).

2. In *powder* it is apt to be adulterated with powdered *pimento* (allspice).

Effects.—In their general operation on the system cubebs resemble black pepper. In moderate doses they act as a general stimulant to the stomach and to the system at large.

In too large doses they cause pain and heat in the stomach and bowels, followed by nausea, vomiting, and purging; along with this the circulation is excited, skin hot and dry, and fever produced.

In addition to their general operation they exert a specific influence on the urinary organs, increasing the flow of urine and imparting to it a peculiar odor.

When they purge they are said to impart the same cool sensation to the rectum as they do to the mouth when chewed.

There are several important consequences supposed to have resulted from the use of cubebs which it is well to be acquainted with.

1. If the bowels are not kept freely open during their use the powder insinuates itself into the mass of fæces and causes excoriations of the rectum.

2. Hemorrhoids have sometimes occurred from the irritating effect on the rectum.

3. Urticaria is another effect which has sometimes been produced by it. Pereira says that he has known an eruption of this kind suspected as being of syphilitic origin.

4. *Hernia humoralis.*—It has been observed by more than one person that this happens very frequently under the use of cubebs.

5. *Paralysis.*—By Mr. Boughton a case is related in the London Medical Gazette in which temporary paralysis followed the use of cubebs in doses of ʒ ij three times a day.

6. *General Irritation and Fever.*—In the first volume of the Medical Gazette Mr. Brodie relates a case in which it was given in chronic inflammation of the bladder. The irritation of the bladder produced by it was so great that it tended as he thinks to hasten the patient's death; and Dr. Thomson gives a case in which the febrile irritation was so great as to endanger the life of the patient.

From the foregoing it would seem that although generally a safe remedy, it ought not to be used with unnecessary freedom.

Mode of Administration. Powder.—This is the common mode of giving it, and the best menstruum is milk. The dose is from ʒss to ʒij in half a tumbler of milk, two or three times a day. To have the full effect it should be freshly pulverized.

Tincture. (℥ v cubebs to lbs. ij proof spirit.)—This is a good preparation and may be given in doses of from ʒj to ʒij.

Oil of Cubebs.—This is obtained by distilling the pulverized cubebs with water. It is a transparent, slightly colored volatile oil, with a hot, aromatic, bitter taste, and the peculiar odor of cubebs.

This produces the same effect as the berry, and is a good form of giving it. The dose to begin with is ten or twelve drops on sugar or suspended in water by mucilage.

Apium Petroselinum (*Parsley*).—A small plant, a native of the north of Europe, but cultivated everywhere in gardens. Every part of it contains an essential oil to which it appears to owe its virtues. The part used is the *root.* This is the most powerful in its operation, yet every part of the plant appears to possess diuretic properties.

Although a common this is a very valuable diuretic in a great number of cases. It is mild in its operation and generally sits well on the stomach. It is admirably suited to those cases of strangury brought on by blisters.

In the ordinary suppressions of urine in children it is a valuable article. To increase the efficacy of it the seeds of the water-melon are frequently added; or the sweet spirits of nitre.

The form of giving it is infusion made by adding a pint of boiling water to ℥i of parsley. The *recent root* is the most efficacious—a teacupful of the infusion may be taken every three or four hours by an adult.—Eberle & Chapman.

Daucus Carota (*Wild Carrot*).—The wild as well as the cultivated carrot is officinal; but though formerly esteemed a diuretic they have lost their reputation. The root of the common carrot is used as a poultice to foul ulcers, and acts as a very pleasant stimulant and corrective.

Buchu.—This is the Hottentot name for several species of plants belonging to the genus *Diosma*, or, according to Willdenow, to the genus *Barosma*. They are shrubs growing at the Cape of Good Hope, and the leaves, when reduced to powder, have long been used by the natives as a perfume to anoint their bodies. The part used in medicine are the *leaves*. These are collected from the *Barosma crenulata*, the *Barosma crenata*, and the *Barosma serratifolia*, and sold in the shops as the *Buchu leaves*.

The leaves are from half an inch to an inch long, and three or four lines broad. They are of a firm consistence, smooth and shining, with serrated edges, and of a pale or yellowish green color. They have a strong and aromatic odor, and a bitterish taste, somewhat resembling that of mint. Their virtues are extracted both by water and alcohol.

Composition.—According to analysis, they contain *volatile oil*, *gum*, *extractive*, *chlorophylle*, *resin*, *lignin*, &c.

Effects.—The Buchu leaves are aromatic and stimulant. Taken internally, they give tone to the digestive organs, promoting the appetite, and correcting nausea and flatulency. In addition to this they are diaphoretic and diuretic; over the urinary organs they are supposed to exert a special influence, and it is in affections of these organs that they are chiefly used.

Mode of Administration. Powder.—Twenty to thirty grs. taken in a little wine two or three times a day.

Infusion.—This is the common form of giving them. ℥ss of buchu to half a pint of boiling water.

Dose.—℥i to ℥ij. two or three times a day.

Tincture.—℥ij leaves to lb. j proof spirits, macerated for seven days and strained—ʒi to ʒiv.

The diseases in which the Buchu has been almost exclusively used are those of the urinary organs. In chronic inflammation of the bladder it frequently proves exceedingly beneficial allaying irritation, and checking excessive secretion. In irritation of the urethra, in spasmodic stricture, and affections of the prostate, it sometimes also does good. Like all remedies,

of this class, however, it is uncertain in its effects. As a stimulating diaphoretic it has also been used with advantage in rheumatism.

Arbutus Uva Ursi.—This is the *bearberry*, and is a small evergreen shrub, growing native in the northern regions of Europe and America. It also grows in the northern part of the United States, particularly in New Jersey.—(U. S. Disp.) It bears a small round berry of a red color. The part used in medicine are the *leaves*. They have a bitter, astringent taste; when fresh, no smell; when dried and pulverized, acquire the smell of Hyson tea. The *powder* is of a light brown color, with a greenish tinge. The young and green leaves should only be used.

The principal ingredient in these is the *tannic acid*; so abundant is it that in Russia they are used for tanning. Besides this, they contain *gallic acid*, *bitter extractive*, *gum*, and *resin*, &c.

Effects.—The uva ursi is astringent and diuretic. Under its use, the urine becomes dark colored, showing the absorption of it into the circulation, and its subsequent elimination through the kidneys. In this way it exerts a peculiar tonic and astringent power over the urinary organs. Upon this principle, it has been used in those cases in which the coats of the bladder are in a relaxed condition, accompanied with increased mucous secretion from them. In various *chronic* diseases of the urinary organs, it has been used with variable success, sometimes doing a good deal of good, at other times none at all. In acute cases, of course it is injurious.

Form.—Powder, ℈i to ʒi three times a day.

Decoction.—Best form, ℥i, water ℥xx. Boil to pint and strain.

Dose.—℥i to ℥ij three or four times a day.

This contains the tannic acid, gallic acid, and extractive of the leaves.—U. S. Disp.

Pyrola Umbellata—Chimaphilia Umbellata.—Known by the common names of *pipsissewa*, *wintergreen*, *rheumatism weed*, &c. It is a beautiful evergreen, from six to eight inches high, found native in the northern latitudes of Europe, Asia, and America, and abounds in every part of the United States. The whole of the plant possesses active properties, but the parts used are the *leaves* and *stems*. The fresh leaves, when bruised, have a peculiar odor. They have a bitter, astringent, and somewhat sweetish taste. The principal constituents are *bitter extractive*, *tannin*, *resin*, and *gum*. Both water and alcohol extract all its virtues.

In its effects, the pipsissewa is very analogous to the uva ursi, being tonic, astringent, and diuretic. Like that, too, it turns the urine black. To the stomach, it is a pleasant tonic; it improves the appetite and increases the general strength. The diseases in which it has been used are chronic affections of the urinary organs, dropsy, and scrofula.

Form. *Decoction.*—℥ij to three pints of water boiled down to a quart.

Dose.—A pint in twenty-four hours.

Pareira Brava.—This is the *Cissampelos pareira*, a plant growing on the Spanish Main and in the West India islands. It is generally called *Pareira brava*, which means *wild vine*, from the supposed resemblance of the root to that of the wild vine. It is a climbing shrub, with a large *root*, which is the part used in medicine.

This comes in roundish pieces from half an inch to three or four inches in diameter, and from half a foot to three or four feet long, sometimes split longitudinally. Externally, it has a dark brown wrinkled appearance, and furrowed cortex. Internally, it is of a yellowish grey color, with concentric rings; very porous and easily split. It has no smell; taste, at first sweetish, afterwards becomes intensely bitter and aromatic.

Composition.—According to Feneulle, it contains *starch*, *soft resin*, *yellow bitter principle*, *brown coloring principle*, *nitre*, with various other salts. More recently, by Wiggers, a new vegetable alkali has been discovered, which he calls *cissampelina*. This is insoluble in water, soluble in ether, alcohol, acids, and of an intense sweetish bitterness.—Christison.

Effects.—Analogous in its action to the Uva ursi; tonic, diuretic, and if used in considerable doses, aperient. Although recently brought into notice, it is not a new remedy. It was introduced into Europe two centuries ago (1648), and gained great celebrity as a specific in affections of the urinary organs. It was even supposed capable of curing stone in the bladder. After that it fell into disuse. Very recently it has again been brought forward, especially by Sir Benjamin Brodie, who recommends it very highly in chronic inflammation of the bladder, and gives it the preference to Uva ursi. Like all these remedies, however, it is uncertain in its operation.

Form and Dose. *Infusion or Decoction.*—The common form is *infusion*. ʒvi—boiling water one pint; macerate for two hours. Dose, ℥i to ℥iij. Brodie boils half an ounce of the root in three pints of water down to one pint; eight to twelve ounces of this to be taken daily.

Extract.—Grs. x to xxx. This is generally added to the infusion to increase its strength. Tinct. of Hyosciamus is also added to allay irritation.

Cahinca.—This is the root of the *Chiococca racemosa* or *anguifuga*, a plant growing in the interior of the Brazils. The term cahinca seems to be derived from the Brazilian Indians. It is a vine-like shrub, growing five or six feet high, with a root two or three feet long and about the thickness of a straw or quill or that of the little finger; of a reddish-brown color externally, with the surface knotty and wrinkled. The part used is

the *bark of the root*, in which all the virtues of the article are supposed to reside. This bark has a bitter nauseous taste—is brittle, hard, and about a line thick. The inner part of the root has no taste.

Composition.—According to the analysis of Caventou and Pelletier, it contains, first, a crystallizable principle, in which all the bitterness of the bark resides. This is called *kahincic acid.* Second, green fatty matter. Third, yellow coloring matter. Fourth, colored viscous matter. The virtues of the article are extracted both by water and alcohol.

They appear to reside in the crystallizable substance.

Effects.—Cahinca is diuretic and tonic and at the same time acts on the bowels; according to the dose in which it is given, it operates as a mild laxative or an active purgative. In considerable doses, it proves emetic also. Like many other diuretics it is by no means certain in its action. If it affects the bowels freely, its diuretic action is generally slight and vice versa.

Form—Decoction.—(℥ ij to a pint of water boiled half away.)

Dose.—One or two tablespoonfuls three or four times a day.

Watery Extract.—This is a good preparation possessing all the virtues of the article.

Dose.—10 to 20 grs.

The diseases in which it is chiefly used are dropsy and catarrh of the bladder.

Muriated Tincture of Iron.—This possesses a good deal of diuretic power, and, in cases requiring the combination of tonic and astringent action on the urinary organs, answers a valuable purpose. In cases of retention of urine from spasmodic stricture, it frequently gives relief. It is to be taken in doses of 10 drops every 10 or 15 minutes, till relief is obtained. This sometimes does not occur until nausea supervenes. Also given in chronic inflammation of the bladder, gleet, leucorrhœa, the latter stages of gonorrhœa, and in passive secretion from the kidneys and bladder.

Dose.—10 to 20 drops or more in some mild diluent.

Mercury.—Of the general operation of mercury on the system, a very full account has already been given. Its general action on the whole secretory system was then specially noticed. Among others it excites into increased action the kidneys and in this way increases the secretion of urine. By most writers on the materia medica, the diuretic operation of mercury is explained exclusively upon the principle of its stimulating the absorbents. By this means an increased quantity of fluid gets into the circulation, which is afterwards directed to the urinary organs. In this way the efficiency of mercury in dropsy is explained. To me this does not appear altogether satisfactory, inasmuch as it excludes the primary opera-

tion of this article on the kidneys. In dropsies mercury acts beneficially in various ways. In the *first* place, by stimulating directly the kidneys, in the same way that it stimulates the liver. It thus restores the functions of these organs, which in dropsy are generally impaired. In the *second* place, it acts by restoring all the secretions of the system, which are all more or less impaired in dropsy. In this way exhalation is diminished from the surface yielding the dropsical fluid. In the *third* place it acts by stimulating the absorbents. In all these ways combined it acts in removing dropsical effusions, and it is for these reasons that it is so efficient.

EMMENAGOGUES.

This term is applied to a class of medicines which is supposed to possess the power of promoting the menstrual discharge. This class of agents has been the subject of much difference of opinion. Many practitioners deny that any article of the materia medica possesses any specific power to act on this so called uterine secretion. That the operation of the supposed emmenagogues is excessively uncertain all admit. Still there are a few agents which do increase the flow, and though many of them do and all may act indirectly, yet practical convenience justifies us in retaining the class that attention may be directed more strongly to their power, whether direct or indirect, specific or general, of promoting the discharge and relieving some very common and very distressing forms of diseases. Suppression of the menses may result from a variety of causes, and is generally, perhaps always, only a symptom of some derangement of the general health, and of course those agents which restore it must do so by acting on the disease of which it is a symptom. Hence, in varying states of the system, bleeding, acrid purges, stimulating diuretics, tonics, antispasmodics, each and all may act as emmenagogues.

Doubting whether we have any article entitled to the name of specific emmenagogues, I shall speak of the articles commonly included in this class under four heads.

1. Stimulating diuretics.
2. Cathartics.
3. Tonics.
4. Local remedies.

Stimulating Diuretics.—The modus operandi of these articles is very simple; by their local impression on the bladder they stimulate the uterus by contiguous sympathy. Of these the most popular are certain vegetable infusions, or the volatile oils obtained from them, as rue, pennyroyal, tansy, &c. Their powers are very commonly (in domestic practice) aided by giving with the infusion a quantity of some ardent spirit as gin, whiskey, or the like. The essential oils of these and other plants are also occasionally given as emmenagogues. There is no reason to suppose that either the infusion or the oils have any special power over the uterus; they act as acrid and very uncertain stimulants, and the number of cases in which they can be advantageously, or even safely used, is exceedingly small.

There are two stimulating diuretics in common use which deserve special notice, cantharides and savin. Of the former I shall give the history when speaking of epispastics; it suffices here to say that from its agency on the urinary organs of which I have already spoken, especially when it produces strangury, it may, by transmitting its irritation from the neck of the bladder to the uterus, stimulate that organ, and sometimes bring on the menstrual discharge. It is generally given in tincture, of which twenty drops twice a day is a good dose to begin with; it may be increased till some symptoms of strangury appear, when it should be stopped and diluents given to relieve the bladder. It is appropriate only to those cases where suppression occurs in dull leucophlegmatic girls. To the nervous, the irritable, the sanguine, it can do nothing but harm.

SAVIN (*Juniperus Sabina.*)—This is an evergreen shrub, growing in the south of France, also in Canada; it rises to about the height of three or four feet. The stem has a brownish bark; the leaves, the part used in medicine, are small and bright green. They have a strong disagreeable odor, and a hot, bitter, acrid taste. Their active principles are given up to both water and alcohol; to the latter in the greater quantity. They contain a large amount of an odorous acrid oil, which is obtained by distillation with water. Nearly fifteen per cent. of oil has been obtained from them.

Effects on the System.—Savin is a stimulant whose action is directed to the pelvic organs. It produces irritation, and sometimes inflammation of the rectum, and has frequently caused abortion, for which nefarious purpose it is not unfrequently used. As an emmenagogue it is rarely used in regular practice, and should only be ventured on in cases like those for which cantharides is advised—the phlegmatic, torpid, unirritable. To the plethoric it would be and often is poison.

Mode of Administration.—Powder—dose ten to twenty grains three times a day.

Infusion and Decoction.—Safer than the powder; *the oil*, one to five drops. This is *the* dangerous preparation.

GUIACUM.—The only form in which this is used as an emmenagogue is the volatile tincture, and this is certainly a most valuable, safe, and reliable article. It is highly recommended by Dewees, who used it with a confidence that he had in very few remedies. It is appropriate to all cases except where excitement and plethora are very manifest.

Dose.—Thirty drops in a glass of milk thrice a day, to be increased till a drachm is taken. If it purge, give a few drops of laudanum with it; if on the contrary the bowels become costive, they must be kept soluble by aloes.

Purgatives that are useful in Amenorrhœa.—Of these I will only mention *aloes* as infinitely the most valuable. It should be given during the interval in doses just sufficient to keep the bowels soluble, but immedi-

ately before the time when the discharge should appear, a few purgative doses may be tried.

Combined with guiac (five grains of each in pill), it often produces most excellent effects.

Tonics given for Amenorrhœa.—Two different classes may be used under different circumstances.

1. The vegetable tonics, of which calumba is the best, may be given as stomachics to give tone to the stomach, and improve the appetite.

2. The ferruginous tonics, which are appropriate to all those cases where anemia and chlorosis are attended with amenorrhœa. Neither of these classes of tonics should be given till the digestive organs are in a healthy state, tongue clean, bowels regular, secretions healthy.

Local Remedies useful in Amenorrhœa. (*a.*) *Leeches.*—These applied to the vulva have been recommended by some with the view of determining the blood to the uterine organs, and aiding in this way in the restoration of the menstrual flux. They have been supposed to be particularly useful in cases where the interruption of the menses has been very sudden, occasioned either by exposure to cold or some violent impression made upon the system; or in cases where determinations to some other organ or organs exist along with the suppression. All this may be true, and, no doubt, in some cases they may prove advantageous. The great objection to them is the difficulty of getting patients to submit to their use. Indeed, the indelicacy attending the application of leeches in this way is so great as to prevent their being generally resorted to. A good substitute, and perhaps preferable in most cases, is to apply them to the inside of the thighs, and to the ankles. Indeed, by Laennec, it is asserted that in these situations they produce quite as great a derivative effect as they do when applied to the vulva, especially if applied to the thighs and ankles at the same. Used in this way they may sometimes be resorted to with advantage.

[I think much more highly of this remedy—use it often and usually with good effect.—Ed.]

(*b.*) *Injection of Aqua Ammoniæ into the Vagina.*—This is an emmenagogue remedy which was originally suggested a few years since by Lavagna, and has been attended with no inconsiderable success. By him, four cases of amenorrhœa are related as having been cured in the same number of days by injections of warm milk with aq. ammoniæ in the proportion of from ten to twelve drops to the ounce. Since then it has been tried in this country, and with success. Dr. Hosack relates a case of amenorrhœa of ten years' standing which had resisted all the ordinary aloetic and mercurial emmenagogues, and which was relieved by an injection into the vagina of aq. ammoniæ and rain water in the proportion of ʒss to ℥viij. The injection was repeated three times a day. It caused a slight degree of irritation, and in about five weeks the menses were

restored. By Dr. Gloninger of Pennsylvania, two cases of a similar kind are also related. In one, madder, polygala senega, hellebore, cantharides, iron, aloetics, and mercurials were all tried without any advantage. After this, injections of milk and ammonia (ten drops to the ounce) were given four times a day. At the expiration of eighteen days, the menses appeared. In another case, by the same means, they were restored in the course of a couple of weeks.—N. Y. Med. and Phy. Jour., vol. iii. p. 38.

(*c.*) *Pediluvia, Warm Fomentations, &c.*—The efficacy of immersing the feet in warm water has long been known. It certainly has a most powerful influence in determining blood to the lower extremities, and in this way intermediately to the uterine organs. In some cases rendering the water stimulating by the addition of mustard has an excellent effect. Warm fomentations, fumigations, and the semi-cupium, act in the same way by relaxing the vessels and determining to the uterine organs. In cases of sudden suppression especially, they frequently have an admirable effect.

(*d.*) *Dry Frictions.*—Frictions on the thighs have been recommended by some as advantageous in restoring the menstrual discharges.

Electricity.—Electricity has been strongly recommended by Nauche and Siebold of Germany, and by Dr. G. Bird in England. It was used at Guy's Hospital with great, and, in some cases, almost instant success. It is proper only in those cases where the other functions being well performed, anæmia not present, the absence of the menstrual secretion is the only symptom of disease. In such cases it will often answer an admirable purpose.

A variety of other substances have been used as emmenagogues, as hellebore, madder, senega, and of late strychnine. Neither of them have held their reputation, or justified the confidence with which they were commended to the profession.

PARTURIENTS.

By this term is meant those medicines which possess the power of aiding and increasing the parturient action of the uterus. Although a number of agents have been supposed capable of producing this effect, yet there is only one whose character is sufficiently established to entitle it to special notice. This is the ergot.

Secale Cornutum.—This is known by the common names of the *spurred rye* and *ergot*. It is a dark-colored crooked excrescence growing from the rye, pointed at its extremities, and resembling the spur of a cock. Concerning the nature and origin of this very singular substance various opinions have been entertained. By De Candolle, it is supposed to be a parasitic plant belonging to the natural order of the Fungi; and he gives to it the name of the Sclerotium clavus. Others suppose it to be nothing more than a disease of the grain itself, produced, as has been conjectured by some, by the puncture of an insect. More recently Mr. Quekett, who has made the ergot the subject of an elaborate investigation, asserts that it "is produced by a particular species of fungus, which developes itself upon or in the grain, whilst the latter is very young, causing its remarkable alteration from a healthy state, in form, color, chemical composition and properties." And the ergot, he considers to be "a mass composed of the constituents of the diseased grain, mixed with fungic matter, occupying the place of the healthy ovary, of which can be observed some relics in its triangular shape, and the furrow on one of its sides, both conditions being those of the perfect grain also." To the fungus producing the ergot, Mr. Quekett proposes giving the name of *Ergotœtia abortans*.*

Rye, although the most common, is not the only grain on which the ergot grows—it is found, also, attached frequently to barley and wheat. Moisture seems to favor very greatly its production, as it is usually found in low and moist situations, in wet seasons and in newly cleared grounds.

Properties.—The ergot is generally about half an inch or a little more

* Observations on the Anatomical and Physiological Nature of the Ergot of Rye, and some other Grasses. By Edwin J. Quekett, Esq., F.L.S. Jour. of Pharmacy, vol. x. p. 116.

in length and half a line or more in thickness—curved in its shape, and pointed at its extremities—with a deep longitudinal groove on one or both of its sides. Externally its color is deep violet, internally white. Its texture is hard and brittle. It has a slightly acid and pungent (not very marked) taste, and a faint unpleasant odor, which is perceptible, however, only when the article is in considerable quantities. It is specifically lighter than water. Sound rye is heavier. (Thomson, p. 466.)

Chemical Composition and Properties.—According to Vauquelin, ergot contains the following constituents: first, a yellow fawn-colored matter, soluble in alcohol; second, a violet-colored matter, insoluble in alcohol, but soluble in water; third, a sweetish oleaginous matter, in great abundance; fourth, a free acid, probably the phosphoric; fifth, an azotized matter in great abundance, which easily became putrid; sixth, free ammonia, which escaped at the temperature of boiling water. (See Guibourt and Thomson.)

The virtues of ergot are yielded both to alcohol and water.

Effects.—Aside from its peculiar and truly specific effects on the uterus, ergot in the usual dose in which it is given as a parturient has very little if any effect on the system. In large doses it affects the brain and nervous system, causing headache and giddiness. It also produces severe irritation of the stomach and bowels, nausea, sometimes griping, purging with cramp in the legs. It is upon the uterus, and especially the pregnant uterus, that ergot shows its powers. When given to a woman in labor it calls into most vehement action the contractile powers of the uterus. The pains thus excited differ most markedly from those of natural labor. Instead of the alternate contraction and relaxation of the uterus which takes place in the latter, the contraction is permanent, or continued with only partial remissions. The pains accordingly do not intermit as in natural labor, but there is a constant contraction, though not equally severe at all times. An interesting and valuable peculiarity attending the action of this agent is that it produces its effect on the uterus with great promptitude. As a general rule it develops its action within twenty minutes or half an hour.*

Another peculiarity attending the action of the ergot is that it leaves the uterus in a state of permanent tone after its contents have been expelled. Hence it is that its action is never followed by hemorrhage.

The effect which ergot thus produces on the impregnated uterus is not limited to the full term of pregnancy. It exerts the same kind of influ-

* In twenty cases observed by Prescott, the time was precisely marked. "In two of them the increased strength of the pains and the continued action commenced in seven minutes from the time the decoction was taken; in one case, it was eight minutes; in seven, it was ten; in three, eleven; and in three others it was fifteen minutes. In the four remaining cases, there was no apparent operation until twenty minutes had expired."—P. 11.

ence during the whole of gestation, and hence it is that it has been too frequently used for the criminal purpose of producing abortion. Whether it really possesses this power has by some been doubted [but abundant experience has settled the question, and the remedy is now used in regular practice to induce premature labor.—Ed.].

Uses of the Ergot.—From the effect of ergot the general use to which it is applicable is obvious. It is to produce uterine contraction, with a view to expel the contents of the uterus or to arrest hemorrhage. Although used empirically long before, the attention of the profession was first called to the value of the ergot as a parturient agent in 1808 by Dr. Stearns, then of Saratoga county in the State of New York. Possessing such remarkable powers it at once attracted great interest and was speedily introduced into general practice. From the account which has been given of its effects it is evident that it is a remedy of great power, and that it cannot be used indiscriminately without much danger. Nevertheless there are certain cases in which it may be used with advantage, and if properly guarded, without risk. Every now and then cases are occurring in which it is desirable, for the safety of the mother as well as that of the child, to quicken the action of the uterus for the purpose of expediting the delivery, and it is in such cases that we are furnished in the ergot with a valuable resource. The rules which should govern its exhibition are few and simple, and are directly deducible from the manner in which it acts upon the uterus. In the first place, it should never be used in the incipient stages of labor. The object of nature in this stage is a specific one, and it is to relax and dilate the mouth and neck of the uterus. In other words, the object here is not to expel the child, but to prepare the parts through which the child has subsequently to pass. Now this is best accomplished gradually and by the repeated recurrence of pains at intervals, just as take place in unassisted labor. To stimulate the uterus at this period by the use of ergot would be creating a disproportion between the means and the end. The uterus would make unavailing efforts, which might terminate in rupture of that organ; or if this did not happen, unnecessary pain and suffering would be given to the patient, while from the long continued pressure to which the child would be subjected, that might be destroyed.

In the second place, it should never be given until the mouth and neck of the uterus are dilated, the membranes ruptured, and the external parts disposed to yield. In other words, it should never be given until the parts through which the child has to pass are in a state to yield readily, and to admit of a speedy delivery, under the forcing and expulsive pains of ergot. On this account it is an agent which as a general rule should be used with great caution in first labors, inasmuch as the parts to be dilated are more unyielding than they are subsequently. In all cases in which the habit is plethoric and the fibre rigid, relaxation ought to be promoted by venesection antecedent to its use. In the third place, it should never be

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given where the presentation is preternatural and where the operation of turning may be required. During the powerful and unremitting contraction brought on by the ergot, this operation would be, if not wholly impossible, attended with great danger.

Lastly, it should never be given except when nature is incompetent to a safe delivery. By too many, it is to be feared, it is used merely as a time-saving agent. Nothing can be more reprehensible than this practice. As a general rule nature is competent to a safe delivery, and we may rest assured that the best plan is to leave her alone to accomplish the work. Artificial and violent interference cannot but be improper.

From the foregoing, therefore, it may be inferred under what circumstances it may be used with advantage. In cases of natural labor where the membranes are ruptured, the os uteri dilated, and the head of the child descended into the pelvis, it may be used, provided the natural efforts of the uterus are unable to accomplish the delivery. In such cases it ought to be used in preference to the forceps.

[Besides its use as a parturient, ergot has been used as a uterine stimulant in a variety of cases, and often with great success. To some of these uses I will allude.

1. It has been, as I before stated, used to bring on premature labor in cases of deformed pelvis. The best plan in these cases is, not to rely exclusively on the ergot, but to give four or five doses at intervals of four to six hours, and then rupture the membranes.

The operation of inducing premature labor for any cause involves very great responsibility, and should never be undertaken without very deliberate consideration, and, if it can be had, a consultation. It should never be done earlier than the seventh month.

2. As a means of exciting uterine contraction, and checking hemorrhage after labor, here ergot is often of great value. It will in many cases do good, and, in proper doses, never can do any harm. It should be given the moment the child is expelled.

3. Ergot has been successfully used to excite uterine contraction and to expel foreign bodies from the uterus; by its agency polypi of the uterus have been crowded into the vagina and brought within the reach of the ligature.

Hydatids have in the same way been expelled. Ergot has been advised in retained placenta; it ought not to be depended on; also in puerpural convulsions, where it is much more likely to do harm than good.—Ed.]

[DANGERS TO BE APPREHENDED FROM THE USE OF ERGOT.

1. Prolapsus Uteri.—Dr. Dewees states that he has heard of several cases of this kind occurring in the practice of a physician who was in the

habit of using it indiscriminately in almost every case of labor. That it may produce this effect occasionally, even in the hands of those who use it discreetly, is proved by a case which is related by the same writer. A lady aborted at a little beyond the fifth month with twins. As the involucra did not come away for some days after the embryos, twenty grains of ergot in powder were given with the effect of bringing them away. The patient, supposing something was still left behind, shortly after took another dose, contrary to the advice of the physician. The result was a renewal of the pains and a protrusion of a considerable portion of the uterus through the os externum. This fact ought to furnish a caution in relation to the use of this article in cases where the contents of the uterus have been evacuated, and where of course there is nothing to prevent that organ from being prolapsed.*

2. Rupture of the Perinæum.—I am not aware that this has actually occurred from the use of ergot. If it has it is not likely to be reported. From the violence of the pain, however, produced by the ergot, it is an accident much more likely to occur than under the ordinary pains of labor, The fact has not escaped the observation of those who have used it. Dr. Ward says, "the contraction of the womb has in some cases been so powerful, that I believe a laceration of the perinæum would have taken place, unless I had prevented it by counter pressure."†

3. Hour-glass Contraction of the Womb and Retention of the Placenta.—It is only recently that attention has been called to this effect of ergot, by Mr. Chavasse, surgeon of Birmingham in England. In relation to it he says, "I am convinced that since the ergot has been called into use, cases of this kind have been of far more common occurrence than formerly,"‡ and he states a number of facts corroborative of the truth of this from his own practice as well as that of some of his professional friends. Mr. Jukes, of Birmingham, states that in his first trials with the ergot, he had no less than six cases of retention of the placenta, almost in succession; three of which are well marked cases of hour glass contraction.§ Mr. Elkington says, that "the exhibition of it was so often followed by irregular action of the uterus, sometimes by increasing and inefficient pains, and by retention of the placenta, that I now seldom use it."‖ Since I have used it less frequently I have had very few cases of retention of the placenta. Mr. P. H. Chavasse confirms the same, and expresses the belief that it is a frequent cause of hour-glass contraction of

* American Jour. of Med. and Physical Science, vol. i. p. 259.

† N. Y. Med. and Phys. Jour. vol. iv. p. 202.

‡ State Trans. vol. iii. p. 352. § Ibid. p. 354. ‖ Ibid. p. 354.

the womb.* He also states that in all the cases which came under his observation, the retention of the placenta was not occasioned by any adhesion of it to the uterus, but simply by the hour-glass contraction.†

Dr. Heane says that "in the administration of ergot he never considers himself safe after the birth of the child, until by slight extension he has drawn the placenta into the vagina, for he has had three cases in which the os uteri has contracted so powerfully round the funis, as to make it necessary to introduce the hand into the uterus, "a painful and difficult task," he adds, "from the resistance which the os uteri offered to every attempt at dilatation."‡

[4. Besides these many and great dangers, there are others affecting the mother, viz. *rupture of the uterus.* No person can witness the tremendous efforts to which the uterus is excited when ergot produces its full effect without the most vehement apprehension of this disastrous accident. Although this may happen in any case, and is therefore an objection to using the drug at all, yet it is more to be apprehended when the ergot is given before the parts are well prepared to give way before the head and permit it to pass without delay.

The violent Shock given to the Nervous System.—From this the patient may not recover for a long time, or it may cause convulsions or puerperal mania. It is to the child that ergot is most fatal. Some have supposed that it has a directly poisonous influence, but this I think is not proven; and its fatal effects, of which, alas! there can be no doubt, are to be explained by referring it to the constant and very violent pressure made on the head. This danger will be diminished—*it can never be avoided*—by not giving the drug till the parts are prepared to let the head pass with facility. I lay it down as a rule to which there are exceedingly few exceptions, that where ergot is given and produces its full effect, if the child is not expelled in half an hour, that child will be still born.—Ed.]

Chronic Uterine Discharges.—In these cases, the ergot is recommended by Dr. Marshall Hall. In one case of menorrhagia, alternating with leucorrhœa, of four years' duration, the ergot was given successfully in doses of five grains four times a day, beginning just before the expected return of the menses. In several cases of leucorrhœa, too, it was used by him with success. The effects of the remedy, according to him, are generally perceived at the end of five days. It should, however, be continued some time longer.§

By Dr. Bellinger, of Charleston, ergot was tried in menorrhagia; and he states the hæmorrhage was increased, and the sufferings of the patient greatly aggravated.‖

Mode of Administration.—Ergot is given in substance, infusion, and tincture.

* Med. Gazette, Jan. 1839, p. 640. † Ibid. p. 355. ‡ Ibid. p. 355.

§ American Jour. of Med. Science, vol. vi. p. 697. ‖ Ibid. vol. vii. 272.

Tincture.—Of the saturated tincture, a drachm may be given every twenty minutes till an effect is produced.

If in *substance*, dose ℈i, to be repeated every twenty minutes, till ergot pains are produced. In this form, ergot very often offends the stomach, causing nausea and even vomiting.

Infusion.—Generally made by pouring a teacupful of water on one drachm of ergot in coarse powder, and giving one fourth every twenty minutes.

[This is the preparation I generally use; I think it more reliable than either of the others.—Ed.]

SEDATIVES.

By Sedatives are meant that class of agents whose direct operation is to lessen action in the system. By some high authorities, the existence of such a class of agents is not merely questioned, but positively denied. I will not go into any lengthened discussion of this point at present, as it will abundantly appear hereafter that though their number is undoubtedly limited, yet there are certain agents whose operation is directly and immediately to lessen action in the system, and that without any previous excitement or any narcotic power. By some writers, sedatives are confounded with narcotics. Now it is true that narcotics, like sedatives, repress and impair action, but between the two there are wide differences.

1st. Although both in their ultimate effects repress action, yet narcotics in their primary action are exciting, while sedatives are directly and immediately repressing. For example, opium is in its first action exciting, and only secondarily does it prove sedative—it is a narcotic. Bloodletting, on the other hand, is at once depressing—it is a sedative.

2d. Sedatives act mainly on the vascular system, while narcotics affect most obviously the nervous system.

3d. The practical application of the two classes of agents is entirely different; this affords us a strong, and to me controlling, reason for considering them apart.

As the articles belonging to this class are few and important, I shall notice them so fully and elaborately as to preclude the necessity of any further general remarks.

INDIVIDUAL SEDATIVES.

BLOODLETTING.

Less slaughter, I am convinced, has been effected by the sword than by the lancet, that minute instrument of mighty mischief.—*Reid on Nervous Diseases.*

You need scarcely be told that this is one of the most potent agents which the practitioner has to wield in the treatment of diseases. According as it is used, it may either save life or it may destroy it. It is, therefore, essential that you should be thoroughly instructed in the various

circumstances which either indicate or forbid its use. It is the more necessary that this subject should be very carefully investigated in this country, as there is but too much reason to fear that great mischief has been done by the indiscriminate use of the lancet. In discussing this subject, I shall pursue the same order that has been hitherto observed and treat,—

1st. Of the Effects of Bloodletting.—1. *On the Vascular System.*—Here the effects produced are two-fold, viz. upon the blood itself, and upon the system circulating the blood.

(*a.*) *On the Blood.*—The first and obvious effect of bloodletting is the simple diminution of the actual quantity of blood in the system. Although the whole quantity of blood in the system is thus diminished, it does not follow that the quantity in each individual organ is proportionally diminished. Generally speaking, indeed, it is so—in fact it is so with every part of the body except one, and that is the *brain.* From the peculiarity of structure of this organ, it is evident that it cannot admit of the same loss of blood as all the other organs of the body. Indeed, by some this idea is carried so far, as to maintain that under no loss of blood from the system at large can any material change take place in the quantity of blood circulating in the vessels of the brain. This view was, I believe, first promulgated by Dr. Alexander Monro, primus, and has been argued pro and con by Burrows, Abercrombie, and others; professional opinion, though very much divided till of late, has now, I think, settled down to the conviction, that though Dr. Monro's view is not in its full extent correct, yet the variation in the quantity of blood in the brain is by no means as great as in the other organs.

In many cases the veins of the dura mater do not participate in [the general bloodlessness which characterizes this mode of death (hemorrhage). Caspar's Wochenschrift. 1850.

This then is the first effect of bloodletting, viz. to diminish the quantity of the blood in the system generally, without, however, diminishing it in the same proportion in every particular organ.

The blood is also changed in quality, for immediately after a bleeding the vessels take up watery fluid from some part of the system, and thus the proportion of water in the blood is increased and the fluid is less stimulating to the heart and arteries.

[The following table from Becquerel and Rodier illustrates very strikingly the effect of *bleedings on the blood.* It gives the mean results of the first and third bleedings in ten of the patients in Cruveilhier's wards.

	First bleeding.	Third bleeding.
Density of defibrinated blood,	1056·0	1049·6
Density of serum,	1028·8	1025·6
Water,	793·0	833·1

Solid residue,	207·0	176·9
Albumen,	65·0	64·6
Fibrine,	3·5	3·4
Corpuscles,	129·2	99·2

The general conclusion from these tables is that bleedings increase the quantity of water in the blood and diminish its specific gravity; that the quantity of albumen and fibrine is scarcely at all affected, while the corpuscles are diminished in a very notable degree.—Ed.]

(b.) A second effect of bloodletting is to diminish the activity of the circulation. The heart contracts with less power upon its contents and propels a less quantity of blood into the arteries. The pulse, accordingly, which is the index of the heart's action, becomes smaller, less blood and of a less stimulating quality is also sent into the capillaries, and their action is diminished. On the surface you see an evidence of this in the paleness which ensues, and the same takes place throughout the system.

These, then, are the two effects which it produces on the vascular system, viz. lessening the quantity and impoverishing the quality of blood, and, as a consequence, impairing the action of the heart and blood-vessels.

2. *On the Brain and Nervous System.*—As the energy of the brain depends upon the due degree of stimulus which it receives from arterial blood flowing through its substance, it is evident that whatever deranges the circulation must also derange the condition of the brain. As already stated, the actual quantity of blood in the brain is in all probability always very much the same. It is mainly the alteration in the composition of the blood that affects the brain; still though the condition of this organ be not affected by any increase or diminution of this fluid, yet there are various other modifications of the circulation which may affect it. For example, although the quantity of blood in the brain at any one time may not vary, yet the quantity circulated in a given period may very greatly, according to the frequency of the contractions of the heart. So also may the power or momentum with which the blood is driven by the heart to the brain, and in both these ways may the energy of the brain be impaired. Now, as already stated, when blood is abstracted by venesection the action of the heart is impaired, the circulation becomes slower, and the force with which it is driven to different and distant parts is lessened. The brain participates in this general effect—the blood is driven less forcibly to this organ, while the quantity circulating through it is also less. The result is that the energy of the brain and nervous system is more or less impaired; accordingly giddiness, sickness at stomach, and even fainting come on.

3. Relaxation and consequent loss of power in the muscles, with coldness and a contracted state of the skin, are effects of the loss of blood so familiar and so easy of explanation that they need only be named.

Circumstances Modifying these Effects. *Age.*—This is a circumstance modifying very greatly the effects of venesection, and requires especial notice as lying at the basis of the use of this important remedy at various periods of life. As a general rule children do not bear the loss of blood as well as adults. A striking illustration of the difference between the effects of venesection in children and adults is seen when syncope happens to be induced. Adults, as a general rule, very readily recover from this state. In children, on the contrary, such is the deficient reaction that they recover very slowly, and this state is always attended with more or less danger. Armstrong says, "do not bleed to actual syncope in children, as they are apt to fall into convulsions, of which they may die. Another reason is that a violent reaction takes place after syncope. Children do not recruit from very large bleedings like adults, especially in a confined atmosphere."

From twenty to fifty man is in his fullest strength and vigor, and it is during this period that the loss of blood can best be borne by the human system.

In *Old Age* the action of the heart is impaired, the circulation becomes slower, and the general powers of the system sensibly fail. Under the loss of blood, as a matter of course, reaction does not so readily take place, while, if the quantity be at all large, great prostration will follow. Hence at this period although moderate quantities of blood may be taken with benefit, and are indeed frequently rendered necessary by the venous congestions to which at this period of life we are especially obnoxious, yet excessive depletion is often succeeded by dangerous or even fatal sinking of the system.

2. *Sex.*—Other things being equal, as a general rule, females do not bear the loss of as much blood as males. This is owing obviously to the greater delicacy of their constitutions as well as the more simple mode of their living. In considering the effects of venesection on the female system, there are three conditions of it which require to be noticed—that of *menstruation*, *pregnancy*, and that immediately succeeding the *cessation of the menses.*

During *menstruation* the use of bloodletting has been by many objected to, but without just reason. The ordinary menstrual discharge is by no means so great as to produce anything like debility in the system from its mere quantity, and to render the loss of blood by artificial means at all objectionable, if it should be necessary. You should, therefore, never be deterred from the use of this remedy under these circumstances, provided the other symptoms require it.

During *pregnancy*, also, prejudices have existed against the use of venesection. As a matter of fact, however, bloodletting is much better borne in this state than in the ordinary condition of the system, and when diseases occur during the term of pregnancy much larger quantities can

be abstracted; and indeed, are absolutely required to subdue the disease.

By some it is supposed that the loss of any considerable quantity of blood during pregnancy might be injurious to the fœtus. This, however, is no less incorrect than the former. In no case can the fœtus suffer directly from the abstraction of blood in any ordinary quantity in cases of acute disease. As to the tendency which it may have to occasion abortion and indirectly injure the fœtus, this must depend upon circumstances.

After the cessation of the menses, the general tendency of the system is to become plethoric. This is the natural consequence of the suspension of a long continued discharge from the system. Hence, at this period, diseases indicative of this state are so common, such as apoplexy, paralysis, hæmoptisis, hydrothorax, angina pectoris, scirrhus. Venesection at this period not only can be well borne, but is very often absolutely called for.

3. *Temperament, or Peculiarities of Constitution.*—As a matter of course, vigorous constitutions bear the loss of blood generally better than those of opposite habits. The nervous and irritable particularly, bear bloodletting very badly. What is singular in the effects of bloodletting, vigorous and athletic subjects not unfrequently faint on the loss of a very small amount of blood, while more delicate persons can sustain the loss of considerable quantities without apparently feeling it. Other things being equal, fat persons cannot bear the loss of blood so well as lean ones. This is owing to two circumstances, viz. their having less blood, and the bloodvessels themselves having less tone and power.

Peculiar idiosyncrasies of constitution, too, modify the effects of venesection. In some persons there is a remarkable tendency to inflammatory action. All their diseases partake of this character. In these cases larger and more prompt depletion is requisite, and can be better borne. Some persons, on the other hand, cannot sustain the loss of blood.

Besides these constitutional peculiarities, there are others equally important, and which result from the *habits and mode of life.* A person bred up to habits of industry and temperance, and along with these, enjoying the benefit of wholesome food, pure country air, and above all, a mind free from care and depressing passions, will bear venesection incomparably better than one whose constitution is undermined, and whose vital energies are wasted by the unavoidable deprivations to which the poor are subject, or by the voluntary excesses, debauchery, and intemperance of the rich.

With regard to the use of the lancet in persons who have long been addicted to habits of intemperance, I cannot too strongly urge upon you the necessity of caution. I do not wish you to understand me as interdicting its use altogether in these cases. It may be used here as in every other case where the nature of the disease requires it. The quantity and extent of it, however, should always be modified by the circumstance just mentioned.

4. *Climate and Season of the Year.*—By some it has been supposed that in warm weather and in hot climates, venesection is a remedy which ought not to be resorted to for fear of the debility which it might induce. This, however, is a great error. In every season and under every climate, bleeding may be practised with safety and advantage. Nevertheless, there can be no doubt that under certain conditions of season and climate, this evacuation can be much better sustained by the constitution than under others.

As a general rule, bleeding is better borne during the winter and spring than it is at other seasons. The reason is obvious. In the winter and spring, from the tonic effects of cold, the solids of the system enjoy the greatest vigor, and it is then that the tendency to inflammatory complaints is the greatest. In the summer and autumn all the solids are relaxed, and the tendency is to disorder of the digestive organs. In *dry weather*, too, it is better supported than in moist.

Of the modifying effect of mere temperature, a striking instance is related by Mr. Hennen. In the account which he gives of the hospital gangrene among the troops in Spain, he states that anterior to the month of October, the disease was of such a typhoid character as to render bloodletting altogether out of the question. At this period, however, a change took place in the weather. From being sultry it became cold; an immediate change in the character of the disease followed, and from this period till the following March, bloodletting was almost the only remedy used, and with the greatest success.

Climate exerts an influence analogous to that of season and temperature. As a general rule in very hot or very cold climates bloodletting is not so well sustained as it is in temperate regions.

In very cold climates bloodletting does not appear to be borne to the same extent that it does in temperate. This is probably owing to the sedative operation of cold on the system, impairing to a certain extent the powers of the arteries. Besides the mere heat or coldness of a climate, there appears to be something peculiar to some regions which renders the system less able to bear the loss of blood. Mr. Boyle states that on the western coast of Africa he found a striking difference in the effects of the "same measures upon patients of apparently similar constitutions, and under apparently similar circumstances" as compared with his experience in the East and West Indies and the Mediterranean. Yet he could see nothing in the temperature of the climate, which about averages that of the West Indies and that of the East Indies, to account for the circumstances.

Peculiar epidemical conditions of the atmosphere too, as they modify the character of diseases, necessarily modify the effect of remedies. Hence it has long ago been observed in certain epidemics that venesection could not be used with the same freedom as it could in others apparently similar.

5. *Repetition of Bloodletting.*—Like every other agent used in medicine this too is modified by repetition. As a general rule a second bloodletting cannot be borne so well as the first, especially if the second take place soon after the first. It is much more likely to produce syncope. In some cases of disease, however, the general rule does not hold good, and a second or even a third bleeding will be better borne than the first.

This is undoubtedly owing to the greater development of the disease after the first venesection rendering the system less susceptible to the loss of blood.

6. *Manner of drawing blood, position of the patient, &c.*—These circumstances modify very greatly the effect of venesection. If the blood be drawn from a large orifice and thus very suddenly from the system, a small quantity will produce as much and even greater effect than a larger quantity drawn gradually from a small orifice. In the first the result may be syncope, while in the second nothing of that kind occurs.

The position of the person during venesection still further modifies all this. If he lie on his back while blood is drawn he can lose a much larger quantity without feeling any immediate effect than he can while either standing or sitting up.

7. *The part of the body from whence blood is drawn.*—Among the ancients and in fact up to the period when the circulation of the blood was discovered, the effects of bloodletting were supposed to differ very materially according to the part from which the blood was drawn; and very precise rules were laid down and scrupulously followed in relation to the particular vessels which should be opened in different diseases. As soon, however, as the circulation of the blood was thoroughly understood, physicians very generally came to the conclusion that it was immaterial from what part of the body blood was taken. Notwithstanding this there is good reason for believing that the effects of venesection do differ somewhat according to the part from which the blood is abstracted, and this fact may therefore in some cases be usefully applied. Drawing blood from the *jugular vein* has long been considered much more efficacious, in affections of the head, than taking it from the arm, and there can be no doubt that it does possess many advantages. Mr. Malgaigne recommends bleeding in the foot in affections of the portal and generative systems. Either the internal or external saphena may be opened. Drawing blood from the *temporal artery* also produces effects different from venesection. Of this, however, I shall speak hereafter.

8. *State of the System as to Disease at the time of Bleeding.*—Of all the circumstances already enumerated, there is none which so greatly modifies the effects of bloodletting as this. In some diseased conditions of the system the loss of much larger quantities of blood can be borne, as well as a more frequent repetition of it than in a state of perfect health, while in other conditions much less. In congestion of the brain, for

instance, immense quantities of blood are often drawn without producing syncope. In inflammation of mucous membranes, on the contrary, the system does not bear the loss of so much. In other diseases again, particularly of an irritative character, the system succumbs much more readily to the loss of the vital fluid. Dr. Marshall Hall, who has investigated this subject with great ability, arranges diseases according to their power of sustaining the loss of blood without fainting in an erect posture in the following way, viz. :—

1. Congestion of the head, or tendency to apoplexy.
2. Inflammation of serous membranes.
3. Inflammation of the parenchymatous substance of various organs.
4. Acute Anasarca.
5. Inflammation of mucous membranes.

Maniacs as a general rule do not bear well the loss of large quantities of blood. Unless the case be recent and the patient have great constitutional vigor, the system is easily prostrated by general bleeding.

Of the Effects of Excessive Venesection.—There is no remedy in ordinary use which produces so powerful and energetic an impression on the system as this, and in many cases it gives rise to a train of symptoms even more formidable and fatal than the disease for which it is prescribed. To be able to discriminate between the effects of the disease and of the remedy, is therefore a matter of the highest practical interest; and it is to be feared that for the want of this discrimination many valuable lives are continually sacrificed.

1. *Of Syncope.*—This is one of the most common and obvious of the effects of a considerable loss of blood, and consists of a temporary suspension of the action of the heart. It is evidently owing to the sudden or great abstraction of blood impairing the action of the heart. In consequence of this the brain, receiving less of the stimulus which it derives from the circulating blood, becomes disturbed in its function. Respiration, of course, suffers next, and from the sympathy existing between the brain and stomach, nausea and vomiting are frequent occurrences, if the syncope be protracted. Now, this effect of bloodletting, although it is exceedingly beneficial in many cases of disease, is yet not altogether unattended with danger to the life of the patient. In some cases, it has proved fatal. It should, therefore, be managed with caution. The first thing to be done in cases of this kind is to place the patient flat on the back. This alone most commonly gives relief, and it does so probably because the heart has still power enough to carry the blood to the brain in the horizontal position. The horizontal posture and perfect rest are the essential precautions to be resorted to in cases of this kind; and it is probably owing to the neglect of these that many fatal accidents have occurred. In addition to this, dashing cold water suddenly on the face, and the applica-

tion of aqua ammonia to the nostrils, are the remedies to be relied on. If the tendency to syncope should return, internal stimulants, such as brandy, wine, and volatile alkali, may be given.

In some cases, however, in debilitated habits, and where the loss of blood has been considerable, the system does not react, and the patient sinks under it. It is proper to remark, that the danger of syncope is generally in proportion to the quantity of blood which has been lost. It is, as before stated, very dangerous to children.

2. *Convulsions.*—This is another effect which follows the loss of large quantities of blood. It is observed most frequently in children, when they are bled until syncope comes on. In adults, however, it also sometimes occurs, and then it is occasioned by the slow abstraction of large quantities of blood at one or more bleedings. In cases of this kind, the spasms are to be controlled by the use of opium in some of its forms (of which the black drop is as good as any), or by hyoscyamus. Dr. Hall recommends also the application of a sinapism to the nape of the neck.

In cases where delirium ensues, an anodyne is the best remedy, and where the patient is comatose, counter-irritants to the neck, epigastrium, and extremities.

The foregoing are the more commonly observed injurious effects of bloodletting. There is another consequence, however, not so apparent, but much more important in its results; and it is particularly necessary that it should be understood, inasmuch as it is apt to lead physicians into the belief that still further abstraction of the blood is requisite. What I allude to is the *reaction after the loss of blood.*

3. *Of the Reaction which follows the Loss of Blood.*—In ordinary cases where blood has been drawn, the vascular system gradually recovers from the loss, and returns to its natural state. In these cases, the reaction may be considered as a healthy process. When, however, large quantities have been lost at repeated bleedings, or by a long continued drain of blood, then this reaction becomes irregular and tumultuous, and it assumes the character which is so apt to deceive the practitioner. The heart palpitates, the carotids have a forcible beat, and the pulse becomes morbidly frequent and throbbing or jerking.

The brain suffers and acquires a morbid sensibility. There is pain of the head and temples—noises of various kinds are heard—sleep is disturbed and startling, and there is great agitation and intolerance of light and sound. The respiration is urgent and hurried, accompanied with panting and sighing and a desire for fresh air.

Now if in this state of things the physician, mistaking these symptoms of reaction for those of cerebral congestion, should have recourse again to venesection, the first and immediate effect would be in all probability to relieve all the symptoms. This relief is only temporary, and continues no longer than until a subsequent reaction takes place. When this reaction

comes on, which it shortly does, all the symptoms are renewed and greatly aggravated. If the loss of blood be still further pushed, the reaction is subdued, but in its place there is a general sinking of the system and death is the result.

Such is the train of phenomena which succeed each other in these cases. It must be very evident that as this reaction is a vital process, its degree and violence must depend upon a great variety of circumstances. In young persons and robust constitutions it will of course be most violent. In children, in persons advanced in years, and in those of naturally delicate and feeble habits, on the contrary, it will be much more moderate. In some cases indeed it may fail altogether in taking place, and then the system sinks gradually under the prostrating effects of the remedy. Sometimes it has terminated in mania, at others in a comatose state. From all that has been said, it is very evident that the effects of the continued loss of blood in this way are of very serious import, and require the greatest skill and caution in their treatment. In cases where the reaction is excessive, it is to be subdued not by a repetition of venesection, but by remedies calculated to calm and compose the system. These are, first, perfect rest of mind and body, and the abstraction of every cause of excitement. Second, opium in some of its mildest forms, or what is better, hyoscyamus. Third, mild nourishment. After a while these will restore the equilibrium of the system and calm the convulsive reaction.

If the action in the head be excessive, as indicated by pain and throbbing, cold spirituous applications should be made. In some cases too it may be necessary to take away blood locally by leeches. A very small quantity thus abstracted is frequently of the greatest benefit. Two or three leeches in these cases have been known to give relief. When delirium is present large doses of tincture of hyoscyamus should be given. It is interesting to observe the blunted sensibilities in syncope and in sinking, and to compare them with the morbidly acute sensibilities of the state of reaction. Sinapisms to rouse and the tincture of hyoscyamus to lull them, are, in their respective places, remedies of the greatest value.—*Hall*, p. 112.

4. *Effusions on the Brain and other parts of the System.*—That bleeding creates a tendency to effusions in different parts of the body is a fact which has long ago been observed. In the brain more especially this has been demonstrated. Dr. Leeds was, I believe, the first person who made experiments with this view upon animals. He bled dogs to death, and uniformly found that whether the blood had been drawn from an artery or a vein, serum was effused into the brain.

With regard to the effect of profuse bloodletting on the other internal organs, our facts are more scanty. Generally, however, the bronchiæ are found clogged and the lungs œdematous. In some cases effusions into the pericardium and cavity of the pleura have been observed.

The great practical conclusion to be drawn from these facts is, that there is a point beyond which bleeding should never be carried. In the application of this principle to apoplexy or hydrocephalus, it is obviously of the greatest importance.

States of the System favorable and unfavorable to the use of Bloodletting.—Under this head I propose not to indicate all those cases in which venesection is absolutely necessary, or in which it is absolutely forbidden, but simply to designate those general conditions of the system more or less favorable to the safe use of this remedial agent. Of the favorable states of the system the following may be mentioned.

1. *General Plethora.*—Other things being equal, just in proportion to the quantity of blood in the system, is it able to sustain the loss of it.

2. *A state of General Vascular Excitement.*—The reason of this is obvious. As one of the effects of bloodletting is to reduce the action of the heart and arteries, it is very evident that when this action is excited beyond the natural standard, the abstraction of blood can be borne much better than in the natural condition of the system. As a general rule, therefore, a state of arterial excitement increases the capability of the system for bearing the loss of blood favorably. To this there are certain exceptions, however, which will be noticed hereafter.

3. *A state of Local Inflammation.*—As local inflammation is always associated with more or less general excitement, there is the same reason for this being favorable to the loss of blood as in the last case. In addition, however, there is another reason drawn from the local affection. This acts as a kind of permanent stimulus to the heart and blood-vessels, and therefore the loss of blood in these cases is less felt than under any other circumstances.

4. *A state of Local Congestion.*—An organ, instead of being actively inflamed, and in consequence of this having its substance overloaded with blood, may get into a state that is denominated that of congestion. Now, this is a state in which the venous system of the part becomes crowded with an unnatural share of blood, and the whole becomes, as it were, apoplectic. In this state the general system, instead of sympathizing as it does in inflammation, by causing great vascular excitement, does it in a different way. There is a general oppression, the circulation instead of being quickened is impeded, and the pulse is actually slower than natural. In short, the system, like the organ affected, is in a state of oppression. Now, this condition is also favorable to the abstraction of blood. By relieving this congestion which oppresses the system, the circulation becomes liberated and more free in its movements; the pulse increases in fulness and frequency, while the whole strength of the patient is invigorated.

The States unfavorable to the loss of Blood are the following: 1. *Where there has been already a considerable loss.*—In these cases the further abstraction of blood may be immediately attended by dangerous if not fatal consequences.

2. *Where in consequence of some shock given to the System, the functions of the Brain and Nerves are partially suspended.*—An instance of this you have in ordinary concussion of the brain. Although it is a very common practice on the receipt of an injury to have instant recourse to venesection, yet nothing can be more irrational or dangerous where the system is in the state just alluded to. The brain and nerves have been so much depressed by the shock that any further debilitation, and especially by such a remedy as bloodletting, would inevitably prove fatal. When the system recovers from this state and reaction is fully established, then bleeding is proper to prevent inflammation. Some authors advise to bleed as soon as reaction begins, thinking thus to prevent the possibility of inflammation. This is a practice to be resorted to with very great caution; reaction is an effort of nature to restore the system to its natural condition, and we should never interfere with it till well assured that it is excessive.

3. *Where the Brain and Nervous System have been affected in a peculiar way by violent injuries.*—An illustration of this you have in ordinary burns or scalds. Here, too, the vital energies are overwhelmed, and a true reaction must be allowed to take place. With this, of course, nothing is so sure to interfere as bloodletting.

4. *Where the Brain and Nervous System have been impaired in their tone by causes of more permanent operation rendering the whole habit nervous and irritable.*—This state may be induced by either intellectual or physical habits. Among the first may be mentioned excessive and irregular mental effort, and among the second may be specially noticed the excessive use of intoxicating liquor.

5. *A state of real debility.*—Of all the states perhaps this is the one most decidedly unfavorable to the loss of blood. You are to distinguish here, however, very accurately between real and apparent debility; while the first is in every respect unfavorable to the loss of blood, the latter frequently requires it. Illustrations of real debility you have in the latter periods of disease; of apparent, in various congestive affections.

5. Of the ordinary modes of judging of the propriety or impropriety of having recourse to venesection. 1. *Pulse.*—The pulse is the index by which we judge of the actual condition of the heart and blood-vessels, and the importance of understanding its relation to morbid states, therefore, must be self-evident. A great variety of pulses have been distinguished by practical observers. Many of these distinctions are, however, altogether too minute to be carried into useful and practical application. The more important are the following, and they all depend

upon various modifications of *the action of the heart*, the *quantity of blood thrown out of that organ*, and lastly the *condition of the arteries themselves*.

1. *A Frequent Pulse*, in which there are a greater number of pulsations in a given time than natural. This pulse depends upon the rapidity with which the contractions of the heart succeed each other. The reverse of this is the *infrequent* or *rare pulse*.

2. *A Quick Pulse.*—This is apt to be confounded with a frequent pulse. It is, however, entirely distinct. A pulse is said to be quick when each pulsation is performed in a shorter time than natural, and has no reference to the number of pulsations in a given time. This pulse depends upon the rapidity with which the heart contracts upon its contents.

It is sometimes also called the *jerking pulse.* The difference then between a frequent and a quick pulse is this. *Frequency* relates to the *number of beats* in a given time. *Quickness* to the suddenness of the individual beats.

The reverse to the *quick pulse* is the *slow* pulse, in which the individual pulsations occupy a longer time than natural. The infrequent and slow pulse generally go together, and for practical purposes may be considered as the same.

3. *A Strong Pulse.*—By this is meant a pulse in which the artery gives resistance to pressure. It depends upon the force with which the heart contracts. The reverse of this is the *weak pulse.*

4. *A Full Pulse.*—The difference between this and the strong pulse is that the former is characterized by its *size* and *volume.* The full pulse depends upon the size of the artery and the quantity of blood thrown out by the heart.

The reverse of the full pulse is the *small pulse.*

5. *A Hard Pulse.*—This is also called the *tense* or *chorded pulse*, and is that pulse in which the artery feels like a wire or tense cord. It seems to depend upon a rigid or spasmodic condition of the artery itself. Generally speaking the hard pulse is full; not unfrequently, however, it is small and quick. When a pulse is hard and small it is called a *wiry pulse.* Sometimes known also by the name of *catgut pulse.* When a pulse is *hard*, *quick*, and *small*, it is called a *sharp pulse.* The reverse of the *hard* is the *soft pulse*, in which the artery yields readily to the fingers and on pressure becomes easily imperceptible.

6. *An Oppressed Pulse.*—This is also known by the name of the *suffocated pulse.* By it is understood that pulse which is apparently weak and small, but which becomes fuller and stronger after depletion. It depends upon a congested state of some portion of the circulating system interfering with the free movement of the blood as well as the action of the heart and blood-vessels.

7. *A Regular Pulse*, when the pulsations in a given time are regular and uniform. The reverse is the *irregular pulse.*

The *irregular pulse* may be considered as of three different kinds, viz:

a. The *intermitting.*—When one or more beats are lost in a given time. This arises from various causes. 1. Organic disease of the heart. 2. Want of blood in the artery or weakness in the heart's action. 3. Disorder of the stomach and bowels, agitation of mind, &c. In many persons it is natural and only disappears in sickness. (Heberden.)

b. The *rebounding pulse,* when two quick strokes are followed by a slow one. This is indicative of aneurism of the aorta, ossification of the valves of the heart, hydrothorax.

c. *Unequal Pulse,* when each subsequent pulsation increases in strength. This, if soft, is said to indicate a sweat.

The foregoing are the most important distinctions worthy of being made in relation to the pulse. To be able to judge correctly of them requires tact and experience, only to be acquired by practical and accurate observation. As aids, however, in examining and judging of the true character of the pulse, the following rules may be observed. For this purpose the artery at the wrist is usually selected because it is more exposed.

In the first place the pulse of a patient should not be judged of from feeling it immediately after entering the sick room. Any kind of emotion will quicken the action of the heart, and of course produce a change in the pulse. The mere presence of a physician, especially if it be a first visit, and the necessary answers to his interrogatories, will very generally occasion some additional excitement. In females and irritable patients this is much more likely to occur. On this account it is proper to wait a few minutes, until the tranquillity of the patient is restored. Perhaps the best plan is to feel the pulse several times during your visit. By a neglect of this plain and simple rule, serious blunders have not unfrequently been committed, especially by those who are ambitious of gaining a reputation for prompt and dashing practice.

In the second place, the position of the patient's arm should be attended to. It should be placed in such an attitude as that all the muscles of the arm are relaxed and pressure of all kind be removed from it.

In the third place, in feeling the pulse, compress the artery firmly with your first three fingers. Then raise the two uppermost gradually. If the pulse be really strong, it will strike fully against the remaining finger. If it be weak, it recovers its fulness gradually.

In the fourth place, feel the pulse in both arms. The necessity of this appears from the fact that the pulse is not always the same in both arms. A congenital difference of this kind is recorded by Morgagni. Morgagni de Sedibus, etc. Epist. 24. Zimmerman relates the case of a lady thirty-nine years of age who had long complained of rheumatism

and of a singular coldness which extended down the right leg to the foot. During several weeks the pulse in the right arm was 50, and in her left from 80 to 92. In the former it was weak, in the latter strong.

In the fifth place, the pulse of children under two years should be felt, if possible, while they are asleep. The necessary restlessness and excitability of children at that age invariably quickens the pulse.

In the sixth place, by some physicians it is advised to use a watch to count the number of beats. This will do very well for a young beginner in practice. After you get a little familiarized with the pulse, however, it is best not to depend upon any aid of the kind; it is apt to fix your attention too much on the mere *frequency* of the pulse. In this way many errors have arisen. The best plan is to accustom yourselves to judge of the pulse by its general character, without confining yourselves to one particular characteristic. The best practical physicians I have ever known never resorted to counting the pulse by a watch.

In the seventh and last place, to judge of the pulse, great experience is necessary. With the exception of the mere frequency of the pulse, which can be measured by a watch, everything else is, as you perceive, a matter of feeling and sensation. To enable you, therefore, to discriminate accurately you must be in the constant habit of feeling the various kinds of pulses. Cultivate the *tactus eruditus*. The importance of this, gentlemen, you will find when you get into practice, and when you see learned physicians differing in consultation and unable to determine whether a pulse is hard or soft. So great a man as Dr. Wm. Hunter is said to have been completely destitute of this nicety of discrimination.

Natural Frequency of the Pulse.—In making up a judgment in relation to the pulse, it should be recollected that there are several circumstances which modify its frequency. Of these, the most important is *age*.

(*a.*) *Age.*—From infancy to old age, the pulse is undergoing a constant change in regard to its frequency, becoming slower and slower as we advance in years.

The general average may be put about as follows:—At birth 140; at two years 100; at puberty 80; manhood 75; old age 60.

(*b.*) *Sex.*—As a general rule in females the pulse is from eight to ten beats more than in males.

(*c.*) *Temperament.*—This also causes a difference in the pulse, the sanguineous for instance having a pulse about 80, while the melancholic seldom exceeds 60.

(*d.*) *Climate.*—As a general rule, the pulse is much slower in the inhabitants of cold regions than in warm.

(*e.*) *Posture.*—The effect of posture on the circulation is exceedingly curious and striking; but until very recently has never attracted much

attention. By Dr. Graves, of Dublin, it has lately been investigated, and by him several interesting facts have been established. In healthy persons he found the pulse in the *erect* posture from six to fifteen beats more frequent than in the *horizontal*. He found this difference, too, to increase with the frequency of the pulse at the time of making the experiment. Thus, if the pulse is only sixty, the difference is not more than six or eight; if the pulse has been raised by exercise to 90 or 100, the difference is frequently as great as twenty or thirty.

On placing the body in an inverted position, i. e. with the head downwards, the pulse was neither retarded nor accelerated, but very much diminished in strength—a fact which Dr. G. explains by "the weight of the blood pressing on the aortic valves, and thus necessarily opposing an unusual impediment to its egress from the left ventricle."

(*f.*) *Time of Day.*—This also makes a difference. In the morning, the pulse is generally more calm and less frequent than in any other part of the day; after meals it generally increases in frequency.

(*g.*) *Idiosyncrasy.*—In many cases the pulse is characterized by some peculiar constitutional idiosyncrasy, rendering it preternaturally frequent or slow. Heberden relates the case of a man aged fourscore, whose pulse during the last two years of his life was seldom over thirty, and sometimes not more than twenty-six; yet, notwithstanding this, he enjoyed good health. Napoleon's pulse is said to have been only forty-four in a minute. Dr. Copland mentions a case of a man eighty-seven years old, in good health and spirits, whose pulse is only twenty-nine in a minute. Dr. Thomson relates the case of a man whose pulse in health was never more than forty-five; and what is very curious, whenever he was feverish, it fell to forty.

Having thus noticed the different varieties which the pulse assumes, and pointed out the circumstances which modify even the healthy condition of it, it will be easy to understand what I have to say in relation to the use of the lancet as indicated by it.

Of all the different kinds of pulses which have been enumerated, the one which calls most imperatively for the use of the lancet is that which is characterized by *frequency* and *hardness*. When this kind of pulse is *present*, it indicates the existence of inflammatory action, and of course shows the necessity of bloodletting. Mere *frequency* of the pulse does not require or justify it. Usually this occurs in habits naturally irritable or rendered so by the operation of debilitating causes, in both of which cases venesection, so far from diminishing, would only serve to increase it. Nor does mere *hardness* of the pulse, unaccompanied by frequency, always indicate the necessity of bleeding. In aged persons, not unfrequently the pulse assumes a peculiar hardness from ossification, or some other organic changes in the artery; it is only where hardness and frequency are combined that venesection is rendered necessary.

The *oppressed* is another pulse requiring the use of the lancet, and here its propriety is indicated by the development or *rise* of the pulse, as it is called, after depletion.

With regard to the other conditions of the pulse, they may or may not indicate the necessity of bleeding, according to circumstances. A very *strong pulse,* when the system is plethoric, and there is danger of local determination, may imperatively require bloodletting, while under other circumstances it may not. Sometimes a *soft pulse* may demand extensive depletion. In pneumonia of the most aggravated kind, this is frequently the case. In consequence of the great engorgement of the cellular substance of the lungs, the left ventricle throws out but a very small quantity of blood at a time. It is to this that the character of the pulse is owing.

Not unfrequently a pulse preternaturally *slow* calls for the most active depletion. This occurs in apoplexy and other diseases, when there is oppression of the brain. In cases of this kind, the pulse is sometimes as slow as fifty and forty in a minute. Here, however, it is necessary to make a nice distinction, as all cases of this kind do not require bloodletting. They only do so when this condition of the pulse exists with active determination to the brain. When it depends on effusion in the brain, the result of previous inflammation, bleeding, so far from doing any good, may be productive of positive injury.

Sometimes a very *small pulse* requires the most copious bloodletting. Illustrations of this occur in such diseases as enteritis, dysentery, &c., where, from the great flow of blood to the internal organs which are diseased, the vessels in the extremities are deprived of their ordinary proportion. How to distinguish when a small pulse requires depletion is not very easy. The rule laid down by Lawrence is, that when the heart beats proportionally stronger than the arteries, bleeding may be resorted to, and vice versa. The only safe rule after all, however, is the actual effect produced on the pulse during the flow of blood. If it fills and rises, it is a proof of its propriety, and vice versa.

From all this it is evident, that however much valuable information may be gained from the state of the pulse, it is by no means an *infallible guide* to the use of the lancet. In all cases it must be taken in connexion with the other symptoms.

2. *Pain.*—This is another circumstance by which a judgment is formed concerning the propriety of venesection. Mere pain, however severe, when unaccompanied by any corresponding derangement in the circulation, does not necessarily require depletion. Striking illustrations of this you have in ordinary toothache and in tic douloureux. Indeed, mere pain does not usually exercise much influence in accelerating the movements of the circulation. A high authority, the late Dr. Heberden, says, "it is often supposed that great pain will quicken the pulse; I am more sure that mere

pain will not always do it, than I am that it ever will." He adds, "the violent pain occasioned by a stone passing from the kidneys to the bladder is often unattended with any quickness of pulse; and the excessive and almost intolerable torture produced by a gall stone passing through the gall ducts, has in no instance quickened the pulse beyond its natural pace, as far as I have observed, though it be a disorder which occurs so frequently; and this natural state of the pulse, joined with the vehement pain about the pit of the stomach, affords the most certain diagnosis of this illness. I have seen a man of patience and courage rolling upon the floor and crying out through the violence of this pain, which I was hardly able to lull into a tolerable state with nine grains of opium, given in twenty-four hours, to which he had never been accustomed, and yet his pulse was all this time as perfectly quiet and natural as it could have been in the sweetest sleep of perfect health." Mere pain, then, does not render venesection necessary. When, however, it is associated with a *hard and frequent* pulse, or with a *strong slow* pulse, as in congestion of the brain, or with general inflammatory symptoms, then it forms a most valuable criterion by which to judge not merely of the necessity of depletion, but of the extent to which it may be carried. You are not to infer, however, that pain is always present, at least in equal degrees in all cases of inflammation; and, therefore, the absence of it is not to deter you from the use of the lancet. In pneumonia, for instance, the pain is by no means so acute as in pleurisy, and yet venesection is equally imperative.

3. *The State of the Tongue.*—A tongue with a white fur, if other symptoms correspond, is an index of the propriety of bloodletting, as it generally indicates the existence of inflammation. The quantity, of course, to be regulated by other circumstances.

Mr. Lawrence, in a lecture on disorders of the digestive organs, speaks of a tongue as white, "not in consequence of its being covered by any deposit or secretion, but as if from the substance of the tongue itself being rendered white. This is observed in cases either of plethora, when passing almost into a condition of disease, or in cases of active inflammatory disturbance, and is an indication of these states rather than of particular disturbance of the stomach. It is a tolerably unerring criterion of the existence of inflammation, and it may be considered as a sign that we ought to bleed those individuals in whom it is noticed."—London Medical Gazette, vol. v. p. 197.

4. *The State of the Skin.*—If along with the other symptoms already noticed the skin be *hot and dry*, it is an additional reason justifying the use of the lancet.

5. *The Nature of the Part Affected.*—This is a very important circumstance in enabling us to judge of the necessity of bloodletting. Analogous symptoms resulting from diseases of different organs require different modes of treatment. Inflammation occurring in different organs demands a totally different use of the same remedy. Diseases of the chest, for instance,

require more prompt and repeated depletion than those of any other organ, and the relief which it affords is more apparent.

Inflammation of mucous membranes does not generally require the same active depletion as that of serous membranes.

6. *The Stage of the Disease.*—This is a very important circumstance in determining upon the propriety of bloodletting. Even in diseases requiring this remedy, if it be delayed beyond a certain period, it is wholly inadmissible. As a general rule, in all cases where it is called for the earlier it is used the better. And this for two reasons. 1. It makes a more immediate and decided impression, and at a time when the powers of the constitution are best able to sustain the loss of blood. 2. It prepares the system in the best possible way for the effective operation of whatever medicines the case may require. After bloodletting, for instance, emetics, cathartics, and in fact all other remedies act more efficiently than they would previously.

7. *Of the Appearance of the Blood.*—By many much stress has been laid upon this as indicative of the propriety and necessity of bloodletting. That the blood assumes different appearances in different conditions of the system is certain, and from these important conclusions may unquestionably be drawn in many cases, especially if taken in connexion with other circumstances. As a general rule, when the proportion of crassamentum in the blood is large, it may be taken as the evidence of constitutional vigor, and of the capabilities of the system for sustaining the loss of blood. As a general rule too, when the crassamentum is very firmly coagulated, the loss of blood can be better sustained than when it is loosely held together. The more slowly too the blood coagulates the better will the abstraction of blood be borne.

Of all the characteristics of the blood that upon which the greatest reliance is usually placed is the *buffy coat.* As this by many is looked upon as a certain sign of the necessity of bloodletting, it is proper to dilate a little upon it. The formation of the buffy coat is owing to the manner in which the blood coagulates. In the ordinary healthy condition of the fluid it coagulates rapidly, and when that is the case the red globules remain diffused throughout the whole mass. In certain morbid states, however, the blood coagulates more slowly and the red globules gradually subside towards the bottom. On examining the blood, therefore, it will be found that while the middle and lower parts of the crassamentum contain the red globules the upper part is destitute of them. This part thus deprived of the red globules makes what is denominated the *buffy coat.* That this *buffy coat* is present in cases of inflammation is unquestionable, and therefore as a general rule it may be looked upon as an index of the necessity of bloodletting. It is not, however, infallible, and too implicit a reliance should not be placed upon it. As the formation of this coat depends (as already explained) upon the slow coagulation

of the blood, it is very evident that whatever modifies the coagulation must also modify this peculiar appearance. For example, if blood be drawn from a small orifice and very slowly, it will coagulate so rapidly as to prevent the formation of the buffy coat, even though under an opposite mode of abstraction it would show it.

On the other hand numerous observations have established the fact that the buffy coat is frequently present when no inflammatory action exists. If blood be taken from a person in full health, after violent exercise, the buff will show itself in the blood. In ordinary pregnancy the blood puts on the same appearance. The same thing is observed in blood drawn from persons under a mercurial course. In the last stages of disease it sometimes shows itself. Sir Astley Cooper relates the interesting case of a patient in Guy's Hospital "in the last stage of *scurvy*, whose blood-vessels were so weak that a slight pressure on the skin produced ecchymosis, whose gums frequently bled, and whose pulse was exceedingly quick and feeble." By way of experiment a small quantity of blood was taken from his arm; "after standing a few hours it became not only buffy but considerably cupped." In pulmonary consumption it not unfrequently continues to be seen to the last moment of life. From the foregoing facts, it is evident that the buffy coat is by no means an infallible criterion by which to judge of the necessity of depletion; it should be considered in connexion with the other circumstances in the case, and if this precaution is observed it may assist materially in forming a correct judgment.

Of the extent to which Bleeding should be carried.—On this subject it is impossible to lay down any precise rule. In determining the quantity to be taken in any particular case, everything must depend upon the constitution of the patient, his general habits, the character and seat of the disease, and above all the effect produced upon the pulse. As a general rule in an adult of ordinary strength of constitution, the quantity may be from fifteen to thirty ounces. The latter may be considered as a full bleeding, although in some cases of acute disease a larger quantity may safely be taken. In acute disease, where the patient is seen in the early stages and when it is desirable to make a decided impression, the best plan is to carry the bleeding so far as to affect the pulse and in some cases to produce actual syncope. With regard to the *repetition* of the bleeding, this must be decided by existing symptoms. If those orginally indicating venesection be not mitigated, or if after being partially subdued, they return with their primitive violence, the remedy may be repeated as a general rule after an interval of about six hours. In cases of great severity, however, or when the disease is known to run its course in a very short period, as in laryngitis, it may be repeated after a shorter interval. Generally, however, the necessity of a second bleeding will be greatly

lessened by conducting the first in such a way as to make a decided impression on the system.

In having recourse to venesection in children, the greatest discretion should be exercised, both in regard to the quantity which is drawn as well as to its repetition. It has already been stated, when speaking of age as modifying the effects of this remedy, that young children bear bleeding very ill. If carried at all far they are apt to sink under it. From a child six months old the average quantity may be put at one ounce, and if necessary to repeat it, another in twelve hours afterwards.

Should young children be bled to syncope under any circumstances? This is recommended in some cases where the child is plethoric and the inflammation runs high. In some very rare cases it may be judicious, but beyond all doubt it should be resorted to, if at all, with extreme caution, and, if the circumstances of the case do not seem imperatively to demand it, it is far better to trust to more moderate bleeding. It should never be forgotten that profuse evacuations at this early age, though they may arrest the existing disease, give a shock to the constitution from which it may not easily recover.

In taking blood from persons advanced in years, due allowance should be made for that circumstance, and more moderate quantities taken than from younger persons.

Different modes of abstracting blood.—These are general and local.

Everything that has already been said applies to general bloodletting and to the ordinary mode in which it is drawn from the arm. The other modes are taking it from the *external jugular vein* and *from an artery.* These require only a brief notice.

1. *Jugular Vein.*—Next to drawing blood from the arm, this is the mode of general bloodletting which has been the most popular. I think that in some cases bleeding from the jugular vein has a great advantage. In the first place it draws blood more directly and immediately from the head, and empties the veins and sinuses of that organ in a way which cannot be accomplished by bleeding from the arm. Hence in certain diseases of the brain its beneficial effects are much more prompt and unequivocal.

In the second place, as the vessel is larger than those of the arm, blood can be drawn with much more rapidity and certainty. The importance of this must be self-evident, after what has been already said in relation to difference of effect between the rapid and slow abstraction of blood. In children, particularly, this is of very great importance, in some of whose diseases, such as inflammation of the brain, croup, etc., you wish to make a prompt impression on the circulation and yet from the smallness of the veins in the arm or back of the hand, this cannot be done without taking a large quantity of blood. At any period after the age of one year the

external jugular is sufficiently large and superficial to be opened. Such being the advantages of this mode of bleeding, it may unhesitatingly be resorted to wherever the case may seem to require it. Notwithstanding this it should not be used where bleeding from the arm will answer, inasmuch as it is attended with more inconvenience and not unfrequently with some danger.

2. *Arteriotomy.*—This is another mode of general bloodletting much more common formerly than it is at present. Among the ancients it was in great favor. At present the only artery opened is the *temporal.* What the precise difference is between drawing blood from the *vein* and an *artery* is a question of importance, and has given rise to some interesting investigations and experiments. The most valuable are those of Dr. Leeds, and from them the following conclusions were drawn.

(1.) Taking blood from an artery diminishes more especially the quantity of venous blood; therefore, arteriotomy is to be performed when the veins are tumid.

(2.) The loss of arterial blood does not speedily disturb the respiration nor the heart's motion, nor does it rapidly break the strength; therefore, when we particularly wish to preserve entire the more important functions let arteriotomy be had recourse to.

(3.) From arterial bleeding, convulsions appear not apt to occur; therefore, against such affections arteriotomy would most avail.

(4.) Blood let from veins does not particularly diminish the quantity of venous blood, but greatly disturbs respiration and the heart's motion, debilitates to a surprising degree, makes the veins very turgid, and induces convulsions; therefore, when the circulation is universally strong as in every active inflammation, venesection will be most serviceable.

Local Blood-letting.—1. *Leeching.*—This is one of the most common of the modes of local depletion at present in use. The animal by whose means it is effected is the *Hirudo Medicinalis*, very common in Europe and in this country, found inhabiting lakes and stagnant pools. The leech is of various sizes, the European leech is generally from one to three inches in length, while the Indian leech is six or seven.

The body of this animal is composed of cartilaginous rings capable of great distension. Its mouth is triangular, and the wound which it inflicts is of the same shape. These animals are very much affected by the weather. During the winter they remain in an almost torpid state, hid deep in ground at the bottom of the pools. They are caught in the spring and autumn, and as they generally rise to the surface before a thunderstorm, this is a very good time for collecting them.

As there is frequently considerable difficulty in making leeches bite well, various modes have been proposed to effect this object. The best are the following. The part to which they are to be applied is first to be well washed, and if covered with hair to be shaved. For the purpose of mak-

ing the leech fasten it is recommended to moisten the part with milk or porter, or what is perhaps still better, to puncture with a lancet so as to draw a little blood. The leeches are then to be confined over the spot by means of a common wine glass. It generally takes from half an hour to an hour for leeches to fill themselves. Commonly after being filled they fall off spontaneously. When they do not let go, they may be separated by means off a pin or thread drawn between the leech and the skin.

The *quantity* of blood which a leech draws must of course vary with the size of the animal, and the facility with which the blood flows. As a general rule, seldom more than about two drachms is procured. The quantity actually taken away by the leeches is small when compared with what may be procured from the bites after they fall off. To do this the part is to be sponged with warm water, or what is better, a common warm bread and milk poultice is to be applied. This causes a free discharge of blood without any inconvenience to the patient.

The facility with which they bite, as well as the quantity of blood, depend greatly upon the character of the surface to which they are applied. In delicate skins, where the capillary circulation is active, more blood is always drawn than in dense and rigid skins. Hence, in children and delicate persons, the hemorrhage from leeches is sometimes excessive. For the same reason, certain parts of the body are more favorable to the application of leeches than others.

Effects on the System.—These are local and general. Their first and immediate effect is to unload the system of capillary vessels upon which they act. In addition to this, by the wounds which they inflict, they cause a certain degree of irritation in the surface. These are the local effects. The general are analogous to those of venesection, and vary according to the quantity of blood which the leeches abstract. The bleeding by leeches may be so managed as to produce only the local effects without involving the general system,

Accidents happening from the use of Leeches.—In speaking of the effects of leeches, these require notice, especially as some of them are of very serious import.

1. The first is *excessive bleeding.* This happens not unfrequently, and occurs most commonly in children and in those whose capillary vessels are very active. In a hot climate it is sometimes difficult to stop the bleeding from leeches as well as from phlebotomy.*

Dangerous and even fatal hemorrhages have thus been known to occur in young subjects. In all cases, therefore, a child to whom leeches has been applied should never be left until after it has been ascertained that there is no danger from this source. Sometimes it is difficult to arrest the bleeding even by artificial means, and various modes of doing this have been resorted to. Generally speaking the application of adhesive

* Ainslie, vol. i. p. 192.

plaster with a compress and bandage will answer every purpose. Another good way is a piece of sponge rolled in flour or gum arabic. The simple application of cold water sometimes succeeds. If, however, the bleeding still continues, the best plan is to put the point of a stick of lunar caustic into the orifice and hold it there for a short time. After this a small piece of punk is to be applied. This generally adheres and puts a stop to the bleeding. In other cases the actual cautery requires to be applied. In Lord Byron's case the bleeding could not be stopped till the actual cautery was used. If after this it should still continue, nothing is to be done but to make constant pressure on the part until it is arrested. Where pressure cannot conveniently be made, Mr. Marshall of Dublin recommends pinching up the portion of skin around the leech-bite, and continuing moderate but not painful pressure for ten or fifteen minutes, when the hemorrhage will be found to have ceased.

2. *Opening into an Artery.*—This sometimes happens from the application of leeches, and requires to be guarded against. A case of this kind occurred in which a temporal artery was thus opened, and Sir Astley Cooper was obliged to divide the artery completely before the hemorrhage could be arrested.

3. *Inflamed Leech-bites.*—This is sometimes an unpleasant consequence of the application of these animals. The best way to treat this is upon the principle of Mr. Higginbottom, by the application of nitrate of silver. Sometimes an erysipelatous inflammation takes place, which has usually been ascribed to the irritable state of the skin. It has been ascertained, however, now to be owing to the forcible pulling off of the leech, causing the teeth to be separated and left in the wound. This shows of course the propriety of leaving the leech to drop off.

Number of Leeches to be applied.—In adults from ten to thirty may safely be applied. To an infant one or two are sufficient.

2. *Cupping.*—This operation is performed by first scarifying the part and then applying exhausted cups, for the purpose of taking off the pressure of the atmosphere. In this way a determination of blood is caused to the part, and a free evacuation from the scarified vessels. Of the particular manner of performing the operation it is unnecessary to speak.

Cupping is analogous to leeching, inasmuch as it bleeds locally; it differs, however, in some important respects. It creates more external irritation, and it has, therefore, the advantage of being more of a counter-irritant—it draws blood more promptly, and lastly, you have the bleeding more under your control; none of the accidents which occur after leeching take place here.

7. Relative Value of General and Local Bloodletting.—General bloodletting takes blood promptly and suddenly from the system; local bloodletting takes it slowly and gradually.

General bloodletting, therefore, makes a prompt impression upon the action of the heart and blood-vessels, from the mere suddenness with which the stimulus of the blood is withdrawn from these organs. This effect may, therefore, be produced almost independently of the quantity of the blood drawn. Local bloodletting, if it affects the heart and circulation at all, must do it by the actual quantity of blood lost. General bloodletting affects the whole circulation and acts upon the system—through the intervention of the general circulation. Local bloodletting on the contrary acts on the capillary system of vessels, and through that on the system at large; or in other words, general bloodletting acts primarily on the heart and arteries, and secondarily on the capillary vessels; while local bloodletting acts primarily on the capillary vessels, and secondarily on the heart and arteries. In general bloodletting all the effects are to be attributed to the mere loss of blood. In local bloodletting there is an additional effect obtained in the local irritation which is caused, and which in some cases is of great practical advantage.

The practical distinction then between the two modes of depletion is this. Whenever you wish to produce a prompt and decided effect on the heart and blood-vessels, and whenever the general circulation requires particularly to be operated on, general bloodletting is to be preferred. When, on the contrary, you wish simply to unload a portion of the capillary system, without any special regard to the general circulation, bleeding by local means may be resorted to.

In children leeching acts as a general bleeding.

8. General Rules to be observed in relation to Bloodletting.

1. *Always bleed a patient yourself, or at any rate be present when your patient is bled.*—The reasons of this are obvious, from what has already been said. The effects of bloodletting differ entirely according to the manner in which the operation is performed—whether by a large or a small orifice, whether the patient be sitting up or lying down, &c., &c. Now all this can only be properly regulated by being present. With regard to the quantity of blood to be drawn it is impossible for a physician to say *à priori* how much blood requires to be taken. This is to be judged of entirely by the effect at the time. In some countries, and I am sorry to say in some parts of this country, the operation of bloodletting is trusted to a distinct class of men—a regulation more objectionable and dangerous cannot be well imagined. Always, then, gentlemen, carry your lancet with you and perform the operation yourselves.*

2. In bleeding have special regard to the orifice which you make. Trifling as this direction may appear, it is nevertheless of the very greatest

* Until recently the Edinburgh College of Physicians prohibited their fellows from using the lancet or the scalpel!!

importance—and the reason is obvious, from the difference of effect produced by the drawing of blood from a large and a small orifice. As a general rule, in all cases there ought to be a good-sized orifice made. Otherwise you will find yourself defeated in obtaining all the advantages to be derived from general bloodletting.

3. In all cases determine precisely what your object is in drawing blood. Unless you do this, you never can direct your bleeding in such way as to attain this object in the best possible manner.

4. When blood is flowing, feel the pulse of your patient. As the object in drawing blood is to produce a certain effect and not merely to take a certain quantity, this is to be judged of only by the effect produced at the time.

5. In bleeding children, the greatest caution should be observed in watching the effects. The best plan is to set them upright, and if any paleness of the countenance or faintishness appears, the bleeding should be instantly arrested. This rule is applicable, whatever be the mode of abstracting blood, whether by venesection, or by leeches, or by cups. With regard to leeches, especially, great care should be exercised. This has already been alluded to, but it cannot be too frequently insisted upon.

6. The kind of lancet which is used is a matter not altogether unimportant. In this country there are two used—the *spring lancet*, and the ordinary *thumb lancet*. In some parts of the United States, the former has entirely superseded the latter. In this city the latter is almost universally used. Although having very little experience with the spring lancet, I am inclined to believe that it is liable to many serious objections. Professor Smith, of Baltimore, has written an instructive paper in which he records a number of accidents which have fallen under his observation from the use of this lancet. He relates one case in which he was called "to extract from the arm of a lady the blade of a spring lancet, which in bleeding had been broken by the quick, smart stroke of the spring, and flying with great force had completely transfixed the vein and buried itself in the parts beneath." Several other cases of the same kind have come to his knowledge—not owing to any want of skill or attention on the part of the bleeder, but from the force with which the blade is driven into the arm. He argues also that the following accidents are more likely to occur from the use of the spring lancet: "first, such injury of the vein as to give rise to inflammation; second, wound of the bronchial artery, and the consequent production of traumatic aneurism; third, wound of the nerve—the production of neuralgia, or even tetanus; fourth, wounds of the "brachial aponeurosis." The whole paper of Professor Smith is worthy of serious consideration.

Practical or therapeutical applications of Bloodletting.—Before proceeding to notice the use of this important remedy in various

diseases, it will be proper to state the different modes in which it proves curative.

Modes in which Bloodletting proves curative.—These are various.

1. By diminishing the actual quantity of blood in the system. In this way unnatural fulness of the general vascular system as well as local accumulation of the blood are corrected.

2. By changing the quality of the blood itself.

3. By diminishing the action of the heart and arteries, and when carried so far as to produce syncope, by suspending temporarily the action of the vascular system. In this way excessive and morbid action of that system is controlled.

4. By impairing the energy of the brain and nervous system, and relaxing the muscles.

5. By relaxing the whole system of capillaries.

In one or more of these modes does bloodletting exert its curative influence in various diseases. In the notice which I shall take of its application, all I shall attempt will be to give a few leading facts and principles. To go into the necessary details in relation to each individual disease would occupy a volume.

Of Fevers.—The general principles upon which the use of bloodletting is resorted to in this class of diseases are the following.

In the first place, it is observed as a matter of fact, that the circulation almost always becomes preternaturally excited. In this state of things there is always more or less danger of some local embarrassment. In the second place, it is observed as a matter of fact, that in a great majority of cases of fever, local embarrassments take place, showing themselves sometimes in the shape of inflammation either of the brain or of the viscera of the thorax, or of the abdomen. In other cases, in the form of simple engorgements or congestions of those parts. Now, in the management of fevers, the great object is to regulate the circulation, so as to accomplish the following objects.

1. To prevent, if possible, any local embarrassments from taking place.

2. To counteract and subdue them when they occur in the shape of inflammation and congestion.

In the accomplishment of these objects the great and important remedy is bloodletting, and it is for these purposes mainly that it is used in fever. Simple and obvious as the general principle would seem to be upon which bloodletting is resorted to in cases of fever, the application of the remedies is not always easy. The reason is that fever presents itself under a great variety of forms and manifestations. It occurs in constitutions essentially different from one another. It occurs under different circumstances of climate and temperature. It arises from various causes. Now, all these circumstances exert an essential influence over the general character of the disease, and of course must greatly modify the treatment. Besides this,

the same fever presents itself in different stages, in each of which the treatment must necessarily vary. If all this be true of the treatment generally, it must be so in an especial manner of a remedy so potent as bloodletting. The due administration of this remedy, therefore, in fevers, requires not merely a knowledge of general principles, but practical tact and extensive experience in adapting these principles to individual cases. To enter a little more into detail, let us briefly notice the different forms of fever.

Intermittent Fever.—This consists of two remarkable periods, in each of which the system is in an entirely different condition—the paroxysm and the intermission. In the period between the paroxysms, or in the intermission, all febrile action has disappeared, and the system has returned to a state of health, with the exception of being somewhat debilitated. In the simple unprotracted form of this disease, too, no local obstruction now exists. In this period, therefore, bloodletting is not required. On the contrary, if resorted to, it might prove actually injurious. The system is already debilitated by the previous paroxysm, and if blood were abstracted it would merely add to the existing debility, and probably render the system more liable to the return of the paroxysm. Besides this, it is to be recollected that in the state of partial collapse which succeeds the paroxysm, the loss of blood cannot be borne so well as under other circumstances. During the intermission, therefore, as a general rule, bloodletting is not advisable. In cases where the paroxysms have been frequently repeated, and permanent local abstractions have taken place, the case is different, and local bloodletting may be resorted to with great advantage.

Let us now see if bloodletting be proper *in the paroxysm.* As already stated, our great object in the use of bloodletting in fever is to prevent or to subdue local engorgement and inflammation. Now, during the paroxysm, there are two periods when these local embarrassments occur—in the cold stage and in the hot. In the cold stage the blood retires from the surface of the body, and all the internal viscera become more or less congested. This applies to the brain as well as to the viscera of the chest and abdomen. In the hot stage, the action of the heart and arteries is excessive and, as is always the case under such arterial excitement, the large viscera are in danger of congestion and even inflammation. In some cases one or the other of these actually takes place. In both of these periods, then, that state of system is present which may require bloodletting. It is not to be inferred from this, however, that it is in all cases necessary. On the contrary, in ordinary intermittent, occurring in a good constitution, venesection is very generally not required. The paroxysm is of short duration, and the congestion during the cold stage, and the excitement during the hot, come to a spontaneous, speedy crisis. Occasionally, however, venesection becomes essential, and therefore it is proper to determine the following points. What period is most suitable for the use of this remedy? What are the circumstances which render it proper? To what extent is it

to be carried? With regard to the period, until very recently, but little difference of opinion existed. To bleed in the cold stage, was considered not merely useless, but dangerous,* and if at all practised, the only proper time for it was during the hot stage. Recently, however, the practice of bleeding in the cold stage has been tried, and has been attended by results quite unexpected. The person to whom we are indebted for this practice is Dr. Mackintosh of Edinburgh. By himself and subsequently by others, it has been tested in a manner sufficiently extensive to establish the fact that the practice is at any rate perfectly safe, and in many cases it has been followed by a speedier termination of the fever than by the ordinary mode of treatment. The general principle upon which this practice is founded, is that such a degree of congestion exists in the cold stage, as in many cases is attended with real danger to the patient. Hence, it has been observed, that when patients die of this disease, it is generally in the cold fit. On examining, too, those who have died in this way, there will be found general engorgement of the brain as well as the other viscera. Now, according to Dr. Mackintosh, the abstraction of blood relieves this state of congestion much more quickly than any other remedy, and thus equalizes the distribution of blood throughout the system. Such is the rationale of this practice, and the results of experience appear abundantly to have confirmed the correctness of it. In the majority of cases, Dr. Mackintosh assures us it cuts short the cold stages and arrests the paroxysm of fever altogether. In many instances, too, it has prevented the return of the paroxysm where the patient had been subject to them for a great length of time, and had tried other remedies in vain.

Dr. Mackintosh then says that bleeding in the cold stage is far preferable to bleeding in the hot stage, and he states a fact exceedingly striking in support of this opinion. Several cases were bled during the hot stage without preventing the recurrence of subsequent paroxysms. Some of these very cases were afterwards bled in the cold stage, and with the effect not merely of stopping the existing paroxysm, but also of preventing its return. Such is the practice and experience of Dr. Mackintosh, which has been tested and confirmed by others. By Mr. Twining, in the East Indies, especially, it has been sustained by numerous observations made both upon natives and Europeans.

The period, however, most usually selected for the abstraction of blood is the *hot stage*, and this would certainly more naturally be suggested as

* Senac, one of the best writers on intermittent fever, says, "But such has been the rashness of some men, that they have ventured to open a vein during the cold fit. This practice is unreasonable and dangerous. When the pulse is so depressed as to be almost imperceptible; when the blood scarcely circulates; when the vital principle seems to be already overpowered, what benefit is expected from bloodletting? Can it be had recourse to without danger in old persons, as such are sometimes known to expire under the violence of the cold fit?" Senac on Fever, p. 196.

the most appropriate. The great vascular excitement—the heat of skin—the flush of countenance—the tendency to cerebral congestion—would all seem to point to it as the period when depletion was most requisite and could most easily be borne; and, indeed, there can be no question as to the propriety of the practice, whenever the symptoms are sufficiently urgent to require it.

Blood may then be taken either in the *cold* or in the *hot* stage of an intermittent. In the former, with the view of liberating the organs from congestion and bringing on speedy reaction—in the latter, with the view of moderating excitement, and preventing or correcting local embarrassments. In the sweating stages venesection is not to be thought of.

With regard to the circumstances which may render this remedy necessary in any case, this must be mainly determined by the extent of local difficulty which may be present, and the dangers to be apprehended from it.

The quantity of blood, too, must be regulated by circumstances, and especially by the effect produced. In some cases a few ounces will answer, while in others a pretty large depletion may be necessary.

Remittent Fever.—This form of fever is marked by the same general phenomena as the intermittent, differing only in degree. It has a cold stage, a hot stage, and a sweating stage; all, however, less marked and distinct. The chill is less severe—the reaction in the hot stage is less full and developed, and the sweating is partial and imperfect. As, therefore, the fever does not come to the same kind of crisis as in the intermittent, the local embarrassments which take place during the cold and hot stages are not so completely relieved as they are in the intermittent. Hence they become more permanent difficulties and are more likely to run into actual inflammation. The organs more especially liable to this are the brain, stomach, and liver; all of which, on dissection, furnish abundant evidence of the previous existence of congestion or inflammation.

Such being the difference between intermitting and remitting fever, the general inference would be that venesection is much more necessary in the latter than in the former. And such is in reality the case.

In the use of bloodletting in this form of fever, there are several circumstances of importance which ought to be kept in view.

In the first place, the earlier in the disease it is resorted to the better. In the early stages it reduces excitement and relieves local embarrassments much more certainly and speedily than it does at more advanced periods. The reason of this is obvious. The longer an organ remains in a state of congestion or inflammation the less control will all kinds of medicinal agents exercise over it, and the greater will be the danger of organic and irretrievable mischief being done. At the same time that early depletion thus relieves most effectually any local difficulty, the constitution is better able to support the loss of blood at this time. This is a matter of infinite

importance in a disease, in which, after a certain period, there is a dangerous tendency to collapse. Another advantage attending the early abstraction of blood is that it prepares the system in the best possible manner for the effective use of other remedies.

In the second place, it is to be borne in mind that, like intermittent fever, the remittent consists of paroxysms, although less marked and distinct; and, as a general rule, the best period for drawing blood is at the height of the paroxysm. When there is a tendency to sweating it should be avoided.

In the third place, in deciding upon the quantity of blood to be abstracted, the best general rule that can be laid down is to be governed by the effects produced at the time. In all cases some impression should be made upon the symptoms, or at any rate upon the pulse. Unless this is done no change of action is produced, and, instead of proving beneficial, loss of blood may serve merely to increase the subsequent debility. The *effect*, therefore, must be the guide as to the quantity. No rule can be laid down as to the actual amount to be taken. In some cases the loss of a few ounces may produce all the desired effect, while in others large quantities may be required.

In the last place, although venesection is a remedy very frequently necessary in this form of fever, yet it is not invariably so; and, therefore, it becomes a question of great practical importance to determine when it is and when it is not required. In determining this question, it is important to recollect that this disease assumes different forms, each of which requires a modification of the treatment, and more especially in the use of so active a remedy as bloodletting. There is the mild or simple fever, the inflammatory, and the congestive. In the first, as a general rule, venesection is not required; in the second, it becomes essential; while in the third, it is also essential, but in more moderate quantities, and with due precautions to ensure reaction.

3. *Continued Fever.*—In this form of fever, bloodletting is to be had recourse to upon the same principles, and with the same objects in view, as in the other forms of fever—to moderate general excitement and to relieve local embarrassments. As continued fever differs greatly in its type by the cause which produces it—by the season of the year—by climate—by the peculiar constitution of the patient, &c., so the use of this remedy may be modified by all these circumstances. In some cases it is not necessary; in others it may prove actually injurious, while in others again it may be essential to save life. At one time general bloodletting may be required, while at another every benefit may be derived from local depletion. All this can, of course, only be decided by the peculiar condition of the patient at the time, and by the presence or absence of particular symptoms.

Affections of the Head.—Before proceeding to notice the application of bloodletting in affections of the head, it is proper to recollect what has already been said in relation to the circulation in the brain and the effects of the loss of blood on that organ. From this, it would seem that the quantity of blood in the brain in the ordinary condition of that organ is always very much the same, and that when from disease or the loss of blood the quantity of that fluid is lessened, the loss is supplied by effusions.

If this be so, it may be asked how can bloodletting effect any change in these cases. To this the answer is that, although the actual quantity of blood in the brain at any given moment may not vary, yet there may be and are other conditions of the circulation in this organ which indicate how the condition of the brain can be changed by bloodletting.

In the first place, the relative proportions of arterial and venous blood in the brain may vary greatly. When the general circulation is loaded the brain may be gorged with venous blood, and arterial blood find no entrance in sufficient quantity, and hence stupor may supervene. On the other hand when the system is drained of blood, the arterial flow of blood upon the head may be excessive from the want of venous distension to retard it; and giddiness, tinnitus aurium, and throbbing in the head may arise from this cause."* In the first of these cases, the loss of blood by venesection would lessen the quantity of venous blood in the brain, which loss would be supplied by an equivalent quantity of arterial, thus restoring the natural and healthy proportions of the two. Here, then, venesection would prove salutary. In the second case, that in which the arterial flow of blood to the head is in excess, the still further loss of blood would increase the difficulty and might result in effusion. Here bloodletting would be injurious and a different course of treatment is required.

In the second place, although the actual quantity of blood in the brain cannot be changed, yet "the impetus with which it enters and the degree of pressure it exerts on the nervous matter, is liable to much change,"† and in this way may the condition and functions of the brain be materially altered. When the impetus of the blood is in excess, especially if some cause should at the same time operate to retard the exit of blood from the brain, such a degree of pressure may be excited as to disturb its functions and perhaps give rise to effusion. In this case bloodletting would operate advantageously by lessening the impetus of the blood, and of course diminishing the pressure on the brain.

On the other hand, when the impetus of the arterial blood is *suddenly* lessened, the pressure on the brain is so much diminished, as to produce

* Mayo, p. 135.

† British and For. Rev. vol. iii. p. 324.

more or less insensibility. In this way the "insensibility of syncope from loss of blood, from the erect posture, and from tapping for ascites," appears to be produced.* Now in this case, venesection of course would be injurious.

In the third place, although the quantity of blood in the brain may not change, the distribution of the blood in the small vessels may. This is the case where particular parts of the brain are in a state of inflammation.† Where this inflammation is acute, it is accompanied by an increased impetus of the blood to the head, which keeps up the inflammatory state in the brain. By venesection this impetus is lessened.

Inflammations of the Brain.—Inflammations may assail either the *membranes* of the brain or the *substance* of that organ. The most accurate observers admit that it is not possible in all cases to distinguish between the two. Dr. Abercrombie says, "our knowledge of this subject is not sufficiently matured to enable us to say with confidence what symptoms indicate inflammation of the substance of the brain, as distinguished from inflammation of its membranes; but the distinction is not of much practical importance."‡ Whatever be the seat of acute inflammation of the brain, whether in the membranes or the substance, the treatment is the same, the only difference depending on the severity of the inflammation.

In acute inflammation of the brain there can be no doubt about the propriety and necessity of bloodletting; and the great thing to be attended to is to draw the blood in such a way as to make the most decided and prompt impression. For this purpose, it should be taken from a large orifice, and in such quantity as to affect the pulse until it merely flutters under the finger, or until syncope in produced. This should be done, of course, as early as possible, with the view of arresting at once the progress of disease, and preventing the inflammation from terminating in effusion. The necessity of arresting the inflammation before effusion takes place must be apparent, from the structure of the head. When inflammation assails those structures which have a natural outlet, effusion to a certain extent may be salutary, by aiding in relieving the inflammation. This is the case when the mucous membranes are inflamed. In the brain, however, there is no outlet for any effusion, and in consequence of this, when it does occur, it is generally destructive. On this account, it is so important to prevent this termination, and this is to be accomplished by early and copious depletion, as one of the means. In the repetition of the bloodletting, we must be governed by circumstances, by the local symp-

* British and For. Rev. vol. iii. p. 325.

† Ibid. vol. iii. p. 326.

‡ On the Brain, p. 26.

toms, and the state of the pulse. "Sometimes one, sometimes two, three, or four bleedings will be necessary."*

Some difference of opinion has existed as to the best vessel from which to abstract the blood. As a general rule, in adults, every purpose can be answered by taking it from the arm, provided the orifice be large and a sufficient quantity be taken. In children, on the contrary, a much greater effect can be produced by opening the external jugular, and in them it may frequently have the preference.

When the force of the disease has been broken, as indicated by the state of the pulse and other symptoms, local bloodletting may be resorted to, if necessary. For this purpose leeches may be applied to the temples, or behind the ears.

In relation to the use of bloodletting, there are two things worthy of notice. The first is, that everything depends upon its being used early, and to a sufficient extent. The second, that to secure its full effect, it must be aided by the use of other means; and among these, none are so efficacious as active purging and the application of cold to the head. With regard to purging, Dr. Abercrombie makes this striking remark, "In all forms of this disease (inflammation of the brain), active purging appears to be the remedy from which we find the most satisfactory results; and although bloodletting is never to be neglected in the earlier stages of the disease, my own conviction is, that more recoveries from head affections of the most alarming aspect take place under the use of very strong purging, than under any other mode of treatment."†

Apoplexy.—Although from the earliest periods bloodletting in apoplexy has been sanctioned by the general consent of the profession, yet by some of the most respectable authorities of modern times the practice has been deprecated. Among these may be mentioned Kirkland, Fothergill, and Heberden.‡ Of the propriety and even necessity of bloodletting in this disease, as a general rule, I make no question. The symptoms during the attack and the appearances in the brain on dissection show clearly that there is such a derangement in the circulation in this organ as to require the abstraction of blood. It is not to be used, however, indiscriminately here, any more than in other complaints, and it depends entirely upon the manner in which it is used, whether it proves salutary or injurious. In the application of bloodletting, the important practical points to be determined are, the *period* when it ought to be used, and the *extent* to which it should be carried.

With regard to the *period* best suited to the abstraction of blood, it is

* Armstrong's Practice, p. 365.
† Diseases of the Brain, p. 174.
‡ See Cooke on Nervous Diseases, p. 137.

of the utmost importance to recollect that apoplectic seizures are not always attended by the same symptoms. In some cases, the pulse is full and strong, and the countenance flushed, livid, and tumid, while in others there is great depression of the vital powers, from the sudden shock given to the brain. In these cases, "the face is pale, the skin and extremities cold, the respiration slow and difficult, the pulse feeble and frequent, while both fæces and urine may be discharged involuntarily."* In some of these cases, the shock given may be so great that the system makes no effort at reaction, while in others reaction gradually takes place, resembling in this respect ordinary concussion of the brain. Now it must be evident that in these two conditions of the system the same treatment will not answer. In the first, prompt and extensive depletion may at once be resorted to with advantage; while in the second, the effect of this treatment would be to depress still further the vital powers, and to destroy any remaining efforts of the system at producing reaction. Here, therefore, bloodletting should not be used until reaction has been insured by the use of suitable stimulants, external and internal. After this has been accomplished blood may be taken.

With regard to the *extent* to which the blood should be taken, this must be determined entirely by existing symptoms. When the patient is strong, full habited, with the pulse full and hard, the face flushed, head hot, and no paralysis is present, bleeding may be freely practised until a suitable impression is made on the pulse. For this purpose, twenty, thirty, and sometimes forty ounces may be taken. This may be repeated, too, in smaller quantities once or twice, according to the state of the system. On the other hand, if the patient be not strong or full habited, if the pulse is feeble, the face not flushed, and the head has little heat about it, depletion must be practised with more caution; and in many cases local bleeding may be advantageously substituted. Of the means used for local depletion, cups would seem to be decidedly preferable to leeches. They take the blood more promptly, at the same time that they make a salutary impression on the brain, by the irritation which they occasion. Patients frequently show evidence of returning sensibility during the operation of cupping. The best places for applying them are the temples, the nape of the neck, or between the shoulders.

From the foregoing, the conclusion is obvious, that although bloodletting is a remedy of great value in these cases, it must be used with caution and certain restrictions, or it may do more harm than good, by exhausting and prostrating the system. Nothing, therefore, can be more irrational than the too common practice of flying at once to the lancet in all cases of this kind.

* Dewees, vol. i. p. 213. See Copland, pp. 100 and 102.

Hydrocephalus Internus.—Although formerly considered as a mere dropsy this opinion is at present very generally abandoned. Modern researches have shown that in this disease the effusion, so far from constituting the disease itself, is merely one of the consequences of an antecedent morbid affection of the brain. By Abercrombie the following important points would seem also to be established.

"1st. That in the ordinary cases of hydrocephalus, the coma and other symptoms attending it are not to be considered as the direct effect of the effusion, but of that morbid condition of the brain of which the effusion is the consequence.

"2d. That we have no certain mark which we can rely upon as indicating the presence of effusion in the brain, as slowness of the pulse followed by frequency, squinting, double vision, dilated pupil, paralytic symptoms, and perfect coma, have been seen to exist without any effusion."

That all these symptoms may exist in connexion with a state of the brain which is simply inflammatory.* It would seem that acute hydrocephalus may be considered as a disease "common in infancy, yet occurring occasionally later in life, the nature of which is inflammation of the brain and its membranes, with a tendency to terminate in serous effusion. The disease is characterized by a combination of all or several of these symptoms—pain in the head, sensibility to light, restlessness, starting from sleep and screaming, squinting, convulsions, dilation of the pupils, coma."†

If such be the nature of this disease, not merely is the propriety of bloodletting evident, but the limits also which should be put to it equally so. During the early stage both general and local bloodletting may be used with advantage for the purpose of arresting the inflammatory action of the brain. As in all other cases the quantity to be abstracted must be regulated by the age of the patient, the severity of the local symptoms, and the state of the pulse. In the second stage, when there is reason to believe that effusion has taken place, the abstraction of blood would be injurious, as it would increase the tendency to effusion. Although, therefore, there can be no doubt that in acute hydrocephalus bloodletting is a proper remedy, yet it is to be recollected that symptoms analogous to those which characterize this disease frequently exist without any inflammation—arising in fact from a condition of things entirely different, viz. the want of nervous energy, the result of debilitating and prostrating causes. This is a form of disease which has been investigated with great skill by Drs. Abercrombie, Hall, and Gooch, and which is admirably described by the latter. It is chiefly indicated by "heaviness of head and drowsiness, without any signs of pain, great languor, and a total absence of all active

* Abercrombie on the Brain, p. 166. † Mayo, p. 165.

febrile symptoms."* If patients with these symptoms be treated upon the supposition of its being inflammation they gradually get worse and die from exhaustion, and in some cases towards the last "with symptoms of oppressed brain, as coma, stertorous breathing, and dilated and motionless pupil."† On opening the head after death, "the blood-vessels were unusually empty, and the fluid in the ventricles rather in excess; in two instances death was preceded by symptoms of effusion, viz. blindness, dilated pupil, coma, and convulsions; and after death the ventricles were found distended with fluid to the amount of several ounces, the sinuses and veins of the brain being remarkably empty."‡ In these cases Dr. Gooch very justly infers that "this sudden effusion was a passive exudation from the exhalants of the ventricles occasioned by a state of the circulation the very opposite to congestion or inflammation."§

Now it must be evident that the mode of treatment here must be very different from that pursued in inflammation. Instead of depletion, purging, &c., remedies of a supporting character must be resorted to. Gooch and Hall relate a number of cases in which wine, ammonia, &c., have been successful in curing the disease.

For the diagnosis see Hall, Gooch, Abercrombie, &c.

Besides the forms of hydrocephalus already noticed there is no doubt that a sudden effusion may take place in children without inflammation. See Warren on the Head.

Mania.—In this disease the use of bloodletting has given rise to much difference of opinion. The practice of Sydenham was to take away eight or nine ounces of blood from the arm in young subjects, and repeat the operation twice or thrice, at the distance of three days between each bleeding, and then bleed once from the jugular. After this, the cure was to be trusted to purgatives.‖ Improving upon the practice of Sydenham, by others, bloodletting was carried to the most extravagant length. Plater states that he bled once a week, and had done so in a case for seventy successive weeks.¶ Rush says, "bleeding is here more necessary than in any other disease, and must be carried further." He gives cases in which he took in one 200, in the other 470 ounces, at forty-seven different bleedings.** On the other hand, Ferriar, an excellent authority, though he sanctions moderate bleedings, says that repeated bleedings, though advised by Sydenham, are hazardous.†† By Willis, bleedings both general and local are condemned; and Burrows says he did not "order venesection in six cases of simple mania in as many years."‡‡

From the conflicting authorities, it is quite evident that the abstraction of blood in mania is a point of practice which requires great judgment and

* Gooch, p. 311. † Ibid. p. 312. ‡ Ibid. p. 319. § Ibid. 320.
‖ Works, 462. ¶ Observat. lib. i. p. 86. (Burrows, p. 588.)
** On the Mind, p. 190. †† Ferriar, p. 181. ‡‡ Burrows, p. 583.

discrimination, and nothing can be more injurious than the wholesale practice of depletion which was formerly in vogue. In some cases, however, bloodletting cautiously used may be advantageous. According to Burrows, the only cases in which general bloodletting can be justified in mental derangement, are those in which there exists a state of plethora, or where apoplexy is pending.* As a general rule, bleeding should only be resorted to when the pulse is hard and tense, and high excitement is present.

Although general bleeding should be used with great reserve, yet local may be resorted to with perfect safety and advantage, either by cups or leeches applied to the head, nape of the neck, or between the shoulders. The quantity of course to be regulated by circumstances.

INFLAMMATION OF THE THROAT AND AIR PASSAGES.—*Tonsillitis.*—It is not in every case of this disease that bleeding, either general or local, is necessary. In many cases, however, it is essential, and the use of it must be governed by the symptoms which are present. If the local inflammation and tumor be great, if there be much febrile excitement, and if with these the patient be full habited and strong, the propriety of general bloodletting cannot be questioned. This may be followed by the application of leeches to the throat. Bloodletting in this complaint is advisable, not merely to aid in subduing directly inflammatory action, but also to prevent any bad effects from the use of emetics, should they be deemed necessary. In all cases of tonsillitis, where the disease is acute and the habit full, there is necessarily a great accumulation of blood about the head; and if under these circumstances emetics were given, permanent injury to the brain might result. In those cases where the habit of the patient is weak, and the constitutional excitement moderate, local depletion answers a much better purpose than general.

Among the modes of local depletion that of scarifying the tonsils is the simplest and most efficacious. Cupping on the back of the neck or behind the ears may also be used with effect. The most common mode, however, is to apply leeches to the throat.

Laryngitis.—As this is a form of inflammation which runs its course with overwhelming rapidity, it is necessary that any remedies which may be used to arrest it should operate with the greatest possible promptness and power. Among these bloodletting and emetics must necessarily take the lead. They act with great promptitude, and if properly administered are capable of producing the best effects on the system. When the symptoms are urgent, the first remedy should be bloodletting from the arm, and it should be used not so much to take away a certain amount of blood as to produce a certain effect—syncope. Unless this is done bloodletting can do little or no good. The blood, therefore, should be taken from a

* Burrows, p. 585.

large orifice, the patient in a standing or sitting position. After this a copious supply of leeches should be applied over the larynx. By some authorities bloodletting is not esteemed a remedy of great value in this complaint. Dr. Armstrong says, "it exercises upon the whole less influence over this than any other form of inflammation."* And he relates two cases in which the abstraction of blood was carried to a great extent without any relief, both patients dying. It cannot be denied that there is much truth in this statement, and the same may be said of every remedy resorted to. The danger in this complaint does not arise from the *extent* of inflammation, but from the peculiar location of it in a part essential to life. The inflammation produces a speedy thickening or effusion which has the effect of obstructing the passage of air into the lungs, and in consequence of which the patient dies from suffocation. It is then the organic change which takes place consequent upon the inflammation rather than the inflammation itself which constitutes the danger; and this change takes place with such rapidity as to leave but little time for action. It is hardly surprising that bloodletting as well as all other remedies should frequently prove so unavailing. Nevertheless bloodletting, if used at the proper period and carried to a sufficient extent, has in many cases proved of evident advantage.† In the early stage of the disease, when the chief symptoms are pain and constriction in the larynx, and when the strength of the system is unbroken, free depletion may be exceedingly beneficial. On the other hand, when organic changes have already taken place in the larynx and the patient is beginning to suffer from the effects of impeded respiration and a want of due arterialization of the blood, when the strength is failing, the countenance becoming waxy or livid and the lips pale, it is very evident that bloodletting, so far from doing good, may do much injury by still further impairing the powers of life. In this case nothing less than tracheotomy can be of any service.

Notwithstanding that I look upon bloodletting as so important an agent in this disease, it is to be recollected that it is only the first of a series of other agents which are to be used to effect a cure. It may make a first and very salutary impression on the disease, but this requires to be properly sustained by the use of emetics, cathartics, blisters, and calomel.

Trachitis.—In speaking of this disease under the head of emetics I mentioned that if taken in the early stage, before the local inflammation is fully established, and before general inflammatory action is excited, it may readily be broken up by the judicious use of emetics and other agents without having recourse to bloodletting. When, however, this period has passed by, and the disease becomes decidedly inflammatory in its character, this will not answer, and more active remedies

* Lectures, p. 381.

† See Cheyne (in Stokes on Diseases of the Chest), p. 156.

must be resorted to. As this disease runs its course in a short time and speedily terminates in the formation of a false membrane, the great object is to prevent this by the use of such means as shall at once arrest the inflammatory action. To accomplish this object no remedy acts with such efficiency as bloodletting. General experience has established the fact, that, if properly used, it exercises a wonderful control over this form of inflammation. The period proper for the use of the lancet is that in which active inflammation is present—when this has terminated in effusion and in the formation of the false membrane, the only effect of bleeding will be to hasten death.* Much difference of opinion has existed with regard to the extent to which bloodletting should be carried. It is impossible to fix upon any precise quantity as suitable in all cases. As the object is to produce a decided impression on the symptoms, bleeding ought to be continued until the pulse flutters under the finger or to approaching syncope.† Actual syncope should be avoided for the reasons already stated. In very young subjects this is the practice which has received the sanction of the best observers, and which has been attended by the most decided success. See Armstrong's Lectures, Stokes, Dewees, Eberle, Mackintosh, Hosack. With regard to the mode of abstracting blood, as a general rule, venesection is preferable to local bleeeding, inasmuch as it makes a more prompt and decided impression. The best place to take the blood from is the arm, when the veins are large enough to admit of it. When this is not the case, it may be taken from the veins on the back of the hand. By some the jugular vein is preferred. Blood may readily be taken from this vessel, but the objection to it is the difficulty of controlling the hemorrhage from the orifice. The coughing and vomiting, if emetics should be given, will be very apt to open the orifice, and thus do mischief.‡

Inflammation of the Lungs.—Inflammation may assail either the mucous membrane of these organs, or the parenchymatous substance, or the investing membrane. Although in all of them bloodletting may be required, yet there is a difference in the extent to which it may be carried. This shows the importance of accurately distinguishing in all, what is the precise seat of inflammation.

With regard to the utility of bloodletting in *bronchitis*, there is a difference of opinion. Laennec says, "although there is an inflammation of the mucous membrane of the lungs, bleeding is rarely useful in it, except in very robust subjects, or where the symptoms are so severe as to threaten peripneumony, or where there is blood in the expectoration

* For cases see Mackintosh, p. 280.

† As a general rule Armstrong recommends ℥ij from an infant a year old, four from one two years old, six from one three years old. Lectures, 386.

‡ See Stokes on Chest, p. 143.

Accordingly, this measure, with the exception just named, has always been rejected by good practitioners, as rendering the disease of longer duration, and as diminishing and sometimes checking the expectoration. Leeching has the advantages and disadvantages of venesection only in a less degree. Cupping is in general more useful. By using many glasses, and yet taking away only a small quantity of blood at once, and more particularly by keeping the glasses applied for a considerable time, so that the tumefaction produced by them does not too speedily subside, we frequently obtain, in the severer cases, marked relief of the oppression and other symptoms."*

Bleeding then is a remedy which cannot be used with the same freedom in this form of inflammation as in many others. In this respect there is a marked difference between bronchitis and pneumonia and pleurisy, the two latter requiring the loss of much larger quantities of blood than the former. The reason of this is to be found in the difference in the tissue which is the seat of inflammation. Inflammation in the mucous membrane of the lungs terminates speedily in effusion or secretion, and the matter thus secreted is soon removed by the natural efforts of the respiratory organs in the process of expectoration. Now this process requires a certain degree of strength in the system, or it cannot be successfully performed. Accordingly in cases where the system is very much exhausted, the patient sinks under the effects of suffocation from the inability to expectorate. Now bloodletting carried too far may produce just such a condition of things. It may so lessen the general strength as to destroy the power of expectoration. In very young subjects who cannot expectorate at all, it is very evident that the difficulty must be greatly aggravated. There is an objection to the use of bloodletting in this disease; yet in the early period, when the cough is dry and before secretion is established, bloodletting may be proper—the quantity of blood abstracted being proportioned to the severity of the symptoms, and the general strength of the patient. After secretion is established, bloodletting is a dangerous remedy. It can do no good in relieving the local inflammation, while it does great harm in impairing the general strength and lessening the power of expectoration. The propriety of bloodletting then must in all cases be determined by the stage of the disease and the general strength. In infants and persons advanced in age, too much caution cannot be observed in making the necessary discrimination in relation to the use of this remedy.

Is general or local bloodletting preferable? In the early stage of the disease and when the strength is yet unbroken, the blood ought to be taken from the arm. Generally speaking, one bleeding will suffice. After this, if necessary, recourse may be had to leeching or cupping. The best

* See Stokes on the Chest, p. 67.

place for applying the cups or leeches is the upper part of the chest. This has been found to be much more effectual than applying to the lower part.* Cups or leeches may be applied under the clavicles or between the scapulæ. In children, leeches will frequently answer every purpose.

In Pneumonia.—This is one of the diseases over which bleeding exerts the most decided curative influence. It is sanctioned by the almost universal consent of practitioners, both ancient and modern. M. Louis is the only exception, and to his opinion that this remedy exercises but little control over pneumonia, I allude only to prevent your being misled by it. Bleeding is in this disease the sheet anchor. But, here, much of the effect of the remedy will depend on the mode in which it is used. The rule is the same to which I have alluded in other inflammations, "*bleed early.*" If you see the patient in the first stage before hepatisation has begun, bleed from a large orifice, the patient standing or sitting up, till a decided impression is made on the pulse, the respiration, and the pain; this will very generally exercise a most favorable influence in the progress of the disease. It is not probable that one bleeding, even though carried to syncope, will suffice. In four or five hours see your patient again, and if the blood you have taken has not prostrated the disease, if pain has returned, respiration has become rapid, fever high, repeat the bleeding, and you may do this a third, and though this will very rarely be necessary, a fourth time if the symptoms demand it. Besides general bleeding, advantage may often be derived from cupping, or in young subjects leeching. If, as is very common, the inflammation affect the root of the lung, it is a very good practice to apply cups over the posterior part of the chest, and afterwards let the patient lie down under a large bran poultice. This is the way in which bleeding should be practised if we see the patient in the first stage. In the second stage the remedy can by no means be used with the same freedom; nor, where its moderate use is admissible, is it at all likely to do the same amount of good. Still, if the patient have some vigor—if the second stage has not advanced very far—if considerable sound lung still remain, a moderate bleeding will have a good effect; if, on the contrary, the patient be feeble, or if the disease has progressed till he begins to be prostrated by it, local must take the place of general bleeding. Here cups may be used as before directed. If, however, the disease has advanced to the third stage, the strength utterly giving way, pulse small and rapid, breathing short and quick, face pale, expectoration like prune juice, the time for bleeding has passed by; and if it be resorted to, whether local or general, we are more likely to hurry forward the fatal termination than to arrest the progress of the disease.

Puerperal Fever.—This is sometimes called *Puerperal Peritonitis*, or

* Stokes, p. 73.

as proposed by Dr. Gooch, *Peritoneal Fever.* It begins a few days after delivery, and its characteristic symptoms are pain and tenderness over the abdomen, and general fever, and a rapid pulse. When it terminates fatally it does so generally about the fifth day, and frequently much sooner. On dissection, it is found that violent inflammation of the peritoneum and pelvic viscera has taken place, terminating in effusions of serum, lymph, and sometimes blood.

With regard to the treatment, although at one time great diversity of sentiment prevailed, yet modern practitioners generally concur in the propriety and necessity of bloodletting as an essential remedy. In the use of this remedy, however, everything depends upon the manner in which it is applied. From the severity of the inflammation and the rapidity of its course, it is evident that to do any good it must be used *very early in the disease*, and at the same time *carried to an extent sufficient to subdue the inflammation.* If, on the other hand, it be not used until the disease has advanced to a certain period, or if it be used too sparingly, the only effect will be to prostrate the general powers of the system, without at all affecting the local inflammation; an analysis of the various cases in which venesection has been used will, I think, fully substantiate the correctness of this statement. The application, then, of this remedy, is a matter of some nicety, and involves several points of great practical importance. What is the proper period for depletion? To what extent is it to be carried? At what period does it become injurious?

1. *What is the proper period for depletion.*—I have already said that to do any good, the bleeding should be resorted to early. In a disease, however, which runs its course in so short a period and with such frightful severity, it is necessary to be a little more precise. By Dr Armstrong, this disease is divided into two stages. The first is that of excitement or inflammation—the second that of collapse. As it is only in the first of these stages that bloodletting can be resorted to, it is important, of course, if possible, to limit its duration as well as to point out the characters by which it may be distinguished. This, however, is not so easy as might a priori be supposed. In the first stage, "the skin is commonly dry as well as hot; but in some instances it is partially damp while it is universally hot, and this is particularly likely to happen when the pain is violent, or where the stomach is affected with nausea and vomiting. The pulse is hardly ever less than 120 during this stage, and in some cases it runs as high as 140 in the minute, or even higher. In general the blood does not flow in a soft, easy, tranquil current, but comes against the finger with a vibrating motion; and more than ordinary pressure is commonly required to stop its course along the artery, which in such cases feels hard and tense, like a cord upon the stretch. Yet, there are some instances in which the pulse is very quick, and peculiarly soft and compressible from the first occurrence of the stage of excitement; though this, so far from being more

favorable, is considerably more dangerous than the hard, vibrating pulse, for it marks a relaxation of habit highly to be dreaded in every form of fever. In this stage, too, the patient complains most of the abdominal pain and soreness, breathes above thirty times in the minute, and rather anxiously, has a white, foulish tongue, considerable thirst, and much febrile restlessness and irritation."*

The duration of this stage is variable, according to Armstrong; it sometimes "runs its course in twelve or fourteen hours; sometimes in twenty-four hours; sometimes it is protracted to forty-eight hours, but seldom beyond the third day."†

In the second stage, or that of collapse, the pulse becomes exceedingly small, weak, and quick, ranging from 140 to 160 in a minute. The respiration becomes much quicker, the skin cool, the abdomen distended, and the pain ceases. Generally the intellect remains unaffected to the last. Now, although these two stages differ essentially, yet it is not easy to ascertain precisely when the one terminates and the other commences. There is no one symptom by which this can be ascertained,‡ and it must be determined by a comparison of all the symptoms. Now, it is only in the first stage, or the stage of excitement, that venesection can be proper. In the second, or that of collapse, the only effect is to sink the remaining powers of life.§ The best general rule, then, that can be adopted is to bleed as early as possible in the disease. *To what extent should the bleeding be carried?* This is a point on which a great difference of opinion has existed. By some a specified quantity of blood is directed to be taken away. The practice recommended by Baudelocque is to take away twelve ounces of blood at first. This is what he calls an experimental bleeding. When this bleeding procures but little relief, if the pulse should continue hard and chorded, and not increased in frequency, he repeats a more copious bleeding at a short interval, and after a few hours a third, if necessary. On the contrary, if after the first bleeding the pulse becomes more frequent, soft, and smaller, at the same time that the pain and swelling of the abdomen increase, he is cautious about repeating it.‖ Where blood-letting is proper, he says, it may be repeated, four, five, or six times, but they should be at short intervals, otherwise their only effect will be to weaken the patient, without subduing the inflammation.¶ Armstrong recommends that the patient should be bled without regard to the quantity of blood, to approaching syncope, "until the pulse completely falters, the face becomes pale, and the hands drop by the side." As soon as the patient recovers from the syncope, he gives him three grains of opium, or 120 drops of the tinct. of opium. In the course of two or three, or at furthest

* Armstrong, p. 38, on Puerperal Fever. † Lectures, p. 640.
‡ Armstrong on Puerperal Fever, p. 39. Dewees on Females, p. 428.
§ Armstrong, p. 76. ‖ P. 335. ¶ P. 338.

four hours, if pain and fever be still present, he bleeds again to approaching syncope, and after this two of opium with three grains of calomel. If the pain and fever still continue, a similar bleeding is repeated after two or three hours, followed by a grain and a half of opium, with three grains of calomel. Generally, he states that a third bleeding was not necessary, and that where he was called early, this practice succeeded in nineteen cases out of twenty. Where any slight degree of inflammation remains after this, leeches may be applied.*

Gooch's practice was, if called a few hours after the attack, to bleed from a large orifice till the patient felt faint. The arm was then tied up, and the head raised, so as to encourage the faintness for many minutes. As soon as the faintness subsided, from ten to twenty grains of calomel were given, and after this half an ounce of sulphate of magnesia, every other hour, until the bowels were freely acted on. When faintness had entirely gone off, from ten to twenty leeches were applied to the tender parts of the abdomen, and after they had fallen off, a large bag poultice was applied to the abdomen, to keep up the bleeding, and act as a fomentation to the parts. He waited now till the cathartic had operated freely and frequently, and the state in which he then found the patient determined him as to a second bleeding. If the abdomen was still painful and tender, and the pulse retained any of its hardness or incompressibility, or if the pulse was not so weak as to forbid a general bleeding, it was again repeated to faintness. On the contrary, if the pulse was small and weak, and only soreness remained, leeches were applied. This treatment, he says, generally arrested the disease. The period during which this treatment is admissible he limits to the first day, in "which it should be begun and ended."†

Is Bloodletting a Remedy applicable in all cases? This is the opinion of some. Baudelocque limits the use of it to sporadic peritonitis; where it is epidemical, especially in hospitals, he thinks it injurious.‡ On this point Dr. Gooch has stated some invaluable facts, and he has shown that there are a class of cases in which bleeding is not a proper remedy. In several cases which he records, in which death supervened in two or three days, no appearance of inflammation in the peritoneum could be detected, neither redness, adhesion, nor effusion of any kind. He thinks this form of the disease occurs in delicate and nervous habits, "when the pain and tenderness have followed any irritable cause, such as severe after pains or a griping purge—when the pulse, although quick, is perfectly soft and even weak. The mode of treating these cases is by opiates (10 grs. of Dover's powders every three hours till the pain is gone), large poultices, and sometimes leeches to the abdomen."§

* Practice, p. 645. † P. 556. ‡ P. 346. § Gooch, p. 103.

Tartar Emetic.—Of this important remedy I have spoken more than once, yet its influence as a sedative is too often essential in the treatment of disease to allow me to pass it by. Of its action as an emetic I have spoken at large. But independently of this, tartarized antimony exerts an influence over the vital powers, and especially over the circulation; it diminishes the action of the heart and arteries, and operates as a direct and most powerful sedative. As such it is used every day in practice, and it is of course very important that you should be aware of the nature of its powers, and of the best way in which to avail yourselves of them in the treatment of disease.

With regard to the mode in which tartar emetic produces its sedative effects, there has been much difference of opinion. By some it has been supposed to be merely the result of the nausea and general relaxation which are known to follow the use of this medicine; while others maintain that without the intervention of these effects, it is capable of acting primarily and directly upon the vascular system so as to lessen its action.* The latter of these opinions seems to be best supported by fact and observation. In acute cases of pneumonia and rheumatism, very large quantities of this article can be given, and the only effect which it produces is to diminish vascular action, without causing other sensible operation, either in the way of nausea, vomiting, purging, or sweating. Facts of this kind unquestionably prove that tartar emetic does exert a primary and independent action as a sedative on the circulation. Notwithstanding this, for practical purposes, it is proper to extend our views of the operation of this agent somewhat further, and to embrace the effects of nausea as concurring frequently most powerfully in producing its effect upon the vascular system.

Circumstances modifying these Effects. *Age.*—From the powerful effect of tartar emetie as a sedative, it is an agent which must be used with great caution in very young subjects. Indeed it requires to be prescribed with the same precaution as bloodletting. From inattention to this fact the most dangerous and even fatal consequences have resulted.

Actual Condition of the System as to Disease.—This modifies in a remarkable manner the effects of tartar emetic. In health it acts as a sedative on the circulation, but at the same time in very moderate doses it affects the stomach with nausea and vomiting, and sometimes free purging and diaphoresis. On the other hand, in certain affections characterized by high inflammatory action, very large doses may be given without producing any other effect than that of moderating the action of the heart and arteries. This is particularly illustrated in pneumonia and rheumatism. For this interesting fact we are indebted to Rosori and the Italian

* See on this Dissertations on Fever. By George Fordyce, M.D., p. 310.

physicians. It has since been confirmed by the French, English, and American practitioners.

Illustrations of the use of Tartar Emetic in the Treatment of Diseases. *Fever.*—As a remedy in fever, the reputation of this agent is well established. Under certain restrictions, with due precaution, it may be used in almost all the forms of febrile disease. The mode in which it proves advantageous is obvious from its effects. It operates by diminishing the action of the heart and arteries, equalizing the circulation, and promoting determination to the surface, and in these ways proves eminently efficacious. Acting powerfully on the system, however, its indiscriminate use is not unattended with danger. Where irritability of the stomach is a symptom of the disease, tartar emetic almost invariably aggravates it, and if persisted in proves exceedingly injurious. Where great debility is present, especially in the advanced stages of fever, this article acts as a poison, prostrating the patient, and hurrying him out of existence. Under other circumstances tartar emetic may be resorted to with great benefit as an auxiliary, and sometimes as a substitute for the lancet. The best form in which it can be used is that of solution, in doses of about one fourth of a grain, repeated every second hour.

Inflammations.—As a general remedy, tartar emetic is used extensively in almost all inflammatory diseases where the stomach is not the seat of irritation, and with the same intention as in fever. In this country, as well as in England, the practice is to give it in moderate doses. Within a few years a new mode of administering it has originated with the Italian physicians, and since then has been adopted in other countries, and the peculiarity of the practice consists in the large doses which are given. This practice arose with the founders of a new theory which has been started within the present century, and which is called the *contra-stimulant theory*, or the *new Italian doctrine*. A brief notice of this doctrine may not be inappropriate, as explaining the rationale of their practice. According to this theory, all medicines are divided into two general classes, viz. *stimulants* and *contra-stimulants*. By contra-stimulants are meant those agents which exert a positive action on the living fibre, opposed to that of a stimulant action, and hence their name. In other words they are direct sedatives. Contra-stimulants are supposed to have the power of subduing excessive excitement, by a specific action of their own, independently of any evacuations being produced from the system. Tartar emetic is one of the substances placed in this class, and, as already stated, the peculiarity of the practice founded on this theory consists in the *large doses* in which not merely this article, but the whole class of contra-stimulants, are administered. It is only, however, in a certain state of excitement of the system, or in the language of the theory, when the *diathesis of stimulus* exists, that these doses can be borne. When an opposite

state of the system is present, the most injurious, if not fatal, results follow from them. When a patient bears these large doses well, and without producing any evacuations in the way of vomiting or purging, it is called a *tolerance* of the remedy, and he is said to *tolerate* it; and it is mainly upon the manner in which the patient tolerates the remedy that the propriety of its continuance is to be determined.

These are four of the leading points of this theory, and it is upon these principles that tartar emetic is used by them in inflammations. The disease in which it has been most extensively used is pneumonia, and the following will serve as a general illustration of the mode of giving it. If the attack is very acute, the patient is first to be bled to the extent of eighteen or twenty ounces. If the attack is mild, this may be omitted. He is then put upon the use of tartar emetic, in doses of one grain dissolved in two or three ounces of sweetened water, to be repeated every two hours. Sometimes the first dose causes vomiting or purging.* After this, however, the patient will *tolerate* the remedy, and he may then go on taking it without any effect of this kind being caused, or any effect produced on the skin. Indeed, when tolerance of the remedy has been once established, it not unfrequently happens that patients become so costive as to require the administration of injections. In ordinary cases, after giving about six doses of the medicine, the patient may be left quiet for seven or eight hours, especially if he has any inclination to sleep. If, however, the disease be violent, and the oppression at the chest be great, the medicine is to be steadily continued until amendment takes place. In some cases, if the symptoms be urgent, the dose is increased to a grain and a half, or two grains. When the disease is mild, the patient does not tolerate the medicine, and the ordinary effects of it are produced. When violent, on the contrary, instead of these effects, it acts more like an opiate, resembling in this respect the operation of large doses of calomel in dysentery. Generally, too, the sedative effects of the remedy are most decided when no evacuations take place. Among the advantages of this mode of treating pneumonia, it is urged that it does not leave the patient so liable to relapses, that the subsequent debility is by no means so great as that which follows the ordinary mode of treatment by copious and repeated bloodletting.

Acute rheumatism is another disease in which large doses of this remedy have also been tried, and with great success. In several cases of this kind I have prescribed a grain of tartar emetic every hour, and with evident success. The most striking cases, however, that have come to my knowledge are those which occurred in our state prison, as reported by Drs. Drake and Manley. In one case, fifty-nine grains of tartar emetic were

* According to Laennec, the greater number of patients vomit once or twice, and have five or six stools the first day. On the following day they have only slight evacuations, and often indeed vomit none at all.—N. Y. Med. and Phys., No. 26.

given in five days, and the patient perfectly cured in eight days from the commencement. In a second case, three hundred and fifty-eight grains were given in nine days, and in a few days after the patient was well enough to leave the hospital and return to his work. In a third case, two hundred and forty-two grains were taken in seven days, and the patient was convalescent. In these cases, a grain was taken every ten or fifteen minutes, and in all of them, with the exception of a little vomiting after the first few days, no evacuations were caused of any kind, and nothing occurred during the administration to cause the least apprehension from any ill effects which might have been anticipated from such large and repeated doses.

Without recommending this practice to imitation, it must be conceded that it presents exceedingly interesting facts, in relation to the extent to which this article may be exhibited in certain conditions of the system. The practice is certainly gaining ground among the best authorities, both here and abroad.

Mode of Administration.—This has already been incidentally noticed. The first dose may be either half a grain or a grain; if this causes vomiting, a few drops of laudanum may be added to the second dose; as soon as *tolerance* is established, the dose may be increased to a grain, or perhaps a grain and a half, and they may be repeated every two or three hours, sometimes indeed every hour, and continued till the disease gives way.

Digitalis.—This medicine was fully treated of under the head of Diuretics, when I called your attention to a somewhat detailed account of its powers as a direct sedative, as manifested particularly in its influence on the pulse. The diseases in which we could avail ourselves of this power were also named. I will not go here into any details, which would of course only be a repetition of what has been said already. One general principle in the use of this drug is sufficiently important to justify a repetition. I mean that digitalis is not a substitute for venesection in inflammatory affections. It is often a useful, sometimes an abused essential adjuvant, but never a proper substitute.

Hydrocyanic Acid (*Prussic Acid.*)—This very extraordinary substance exists in a great number of plants, as the laurel, peach, cherry, bitter almond, &c., &c. It was discovered by Scheele in 1782. He did not, however, make it pure. This was done by Gay Lussac. Hydrocyanic acid is a compound of hydrogen and cyanogen. It is procured in two very different states, viz. the pure anhydrous acid, sometimes called the acid of Gay Lussac, and the dilute, or medicinal, and sometimes called Scheele's acid.

Pure Acid.—This is made by decomposing the bicyanide of mercury with sulphuretted hydrogen, and then distilling off the acid with a very gentle heat, receiving the product in a cold condenser.

Properties.—Pure prussic acid is a limpid, colorless fluid, taste said to be at first cool, but soon becoming hot and acrid. Odor penetrating, and usually compared to that of peach blossoms. This is, however, not correct; its odor is very different; the mistake has arisen from confounding the odor of the acid with that of volatile-oils with which it is commonly associated in plants. It is exceedingly volatile, and if a drop or two be put on glass or paper, it instantly congeals, the rapid evaporation of one part of the acid producing cold enough to freeze the remainder.

It is soluble in both water and alcohol, and is exceedingly prone to decomposition. Magendie says, that left to itself in well stopped phials, it sometimes decomposes in less than an hour. It can rarely be kept longer than a fortnight. It is not used in medicine.

Medicinal Acid.—There are a great number of formulas for the preparation of this acid, for which I refer you to the pharmacopœias.

Properties.—Like the pure acid, this is colorless, and has the same penetrating odor. It is much more easily preserved than the pure, though in this respect there is a great difference according to the process by which it is prepared. That obtained from the action of sulphuretted hydrogen, or the bicyanide of mercury, being most, and that from the action of sulphuric acid or ferro-cyanide of potassium, the least prone to decomposition.* It should be kept in a cold, dark place, in well stoppered opaque bottles.

Effects on the System.—Hydrocyanic acid appears to act immediately and directly on the nervous system, impairing the general sensibility and irritability of the body. This is perfectly obvious when animals are destroyed by it; and the same general effects, differing in degree, are produced by it when given in medicinal doses, provided they be effective. It is, therefore, a direct sedative, and unlike the narcotics in not having its sedative effects preceded by any excitement. Whether it acts on the nerves or by being absorbed, is still a matter of dispute; the extreme rapidity with which it destroys life *seems* to put its absorption out of the question. Yet the predominating opinion is that it is so absorbed. The action, however, induced is on the nervous system, and its effect is to impair energy and depress vital power. It does not directly produce sleep, and its powers as an anodyne are very trifling, if indeed it possess any.

On the Circulation.—Prussic acid lessens the force of action of the heart and arteries, yet it does not possess any power like that of digitalis in making the pulse slow.

On the Stomach.—Its action is directly sedative; it impairs sensibility and controls irritation at the same time; it rather favors secretion.

On the Bowels.—It is rather relaxing, though they are sometimes costive during its use.†

* Christison, p. 116.

† Elliotson, p. 23.

On the Kidneys.—Its effects are not marked, though by some it is thought to increase the flow of urine.

Such are the effects of hydrocyanic acid on the system, and from them are deduced its *practical application to the cure of disease.*

Affections of the Stomach.—Prussic acid has been a good deal used in the diseases of this organ. In controlling vomiting it is second in power to no known agent. In gastrodynia and pyrosis it has been much used, and often with excellent effects.

In Pulmonary Affections.—In this class of diseases the acid had much more reputation than it has preserved. In phthisis it was once proclaimed as almost a specific. But experience has abundantly proved that except as a palliative it is of no sort of use in the disease. As a palliative, however, it is often of very great value; it relieves cough, checks night sweats, and by relieving irritation often promotes sleep. In short, it smoothes the pathway to the grave, and perhaps delays the progress of the patient, but it can do no more.

In Hooping Cough.—Here great advantage may be derived from the acid, if it be used after suitable depletion and evacuation. It mitigates and speedily arrests the spasmodic cough, and accelerates the case. Dr. Thomson says, "in hooping cough I regard it as the sheet anchor of the practitioner." After an emetic and a brisk purge he gives nothing but the acid, gradually increasing the dose.

In Chronic Catarrh it may be used to lull the cough, and diminish the irritability of the bronchial mucous membrane.

In the Acute Inflammatory Affections of the Chest.—Though highly commended by Brera, it cannot be relied on. As a substitute for bleeding, when the inflammatory symptoms are subdued and great irritability remains behind, it will come in very well.

In Dyspepsia.—If this seem to depend rather on an irritable state of the stomach than on inflammation, whether acute or chronic; if the food causes distress, and digestion is attended with pain, hydrocyanic acid will very often afford relief, and sometimes very promptly. In heart disease, though it is lauded by some, its powers are probably not great. Where irritable action of the heart and arteries depends, as in the absence of organic diseases it often does, on disease of the stomach, the acid, by relieving the latter, may remove the former symptoms; where organic disease is present, it can do no good, and may do harm.

Mode of Administration, Dose, &c.—Prussic acid is best taken in simple sweetened water; as it is very apt to rise to the surface, the patient should be warned to shake the phial well before taking the medicine. As a matter of prudence, only a small quantity should be left in the possession of the patient at once; and when a new parcel is obtained, the dose should always be small till it is tried, as the acid varies so exceedingly in strength.

Life has been lost by neglect of this simple precaution! It is best to begin with a small dose, say one or two drops every three or four hours, increasing the dose daily by one drop, till the proper one is ascertained, by the appearance of some physiological effect—the most common of these is a dryness or stiffness of the posterior fauces, with sluggish movements of the tongue. The operation of this acid should be most carefully watched.

External Application.—A lotion made by mixing ten or fifteen drops of the medicinal acid with an ounce of water, is used by some to allay troublesome itching and irritation, consequent on some of the cutaneous diseases. It has also been used with advantage to irritable ulcers.

Tobacco.—This is the *Nicotiana tabacum.* It is a native of America, and its use as an article of luxury was known to the natives long before the discovery of this continent. Baron Humboldt states that it had been cultivated from time immemorial by the people of the Oronoco, and was smoked all over America at the time of the Spanish conquest. According to the same authority, the plant was "first discovered in the Mexican province of Yucatan in 1520, and it was there called *Petum.*" From thence it was transported to the West Indies and North America. Its introduction into Europe took place in the year 1560, where Jean Nicot, at that time ambassador to the court of Portugal from Francis II., of France, purchased some of the seeds from a Dutchman, who had just brought them over to Lisbon from America. By Nicot the seeds were sent to France, and from these the plant was successfully raised in that country. From the agency which Nicot thus had in introducing the tobacco into France, it received, after him, the name of *Nicotiana*, the specific appellation, *Tabacum*, according to Humboldt, being "taken from the word *tabac*, the name of an instrument used by the natives of America, in the preparation of the herb;" or, according to others, from the island of *Tobago*, from which, by some, it is said to have been first brought to Europe. Into England it was introduced by Sir Francis Drake. It owed, however, all its popularity in that country to the celebrated Sir Walter Raleigh, whose eulogium of it rendered it fashionable, and brought it into extensive use.

The history of tobacco forms a curious item in the annals of our race. Next to intoxicating liquor, there is no substance which has gained such an ascendency over human taste and appetite as tobacco. There is no nation on the face of the globe, civilized or savage, where it has not found its way. Europe, Asia, Africa, and America, are all familiar with it. There is no condition of society in which it is not a favored guest. You find it in the palace and the poor-house—in the stately mansion and the humble cottage—in the work-shop and the billiard-room. The lonely exile solaces his weary hours with it—the joyous freeman exults in its

influence. Philosophy muses under its power—poetry is inspired and hardy labor cheered by tobacco. Wherever man is found, its influence is felt and acknowledged. The citizen whiffs his perfumed cigar—the poor man smokes his sooty pipe—the sailor chews his delicious quid—the matron rejoices in her pinch of snuff. On the mountain top and in the lonely valley—on the land and on the broad expanse of ocean—in the dark mines of Pennsylvania and in the glittering halls of Paris—on the rugged hills of Switzerland and in the gold-bearing valleys of California—amid the snows of the North and under the burning suns of the tropics—in battle and in peace—in storm and in calm—in wealth and in poverty—in health and in sickness—the king and the subject—the master and the slave—youth, manhood, and old age—all, all bow to the magic power of tobacco.

What is still further curious in relation to this plant is, that it gained this universal ascendency notwithstanding the most powerful opposition. By the wise it was reprobated, by the powerful it was denounced. Even popes and monarchs did not consider it beneath their dignity to engage in the general crusade waged against it. To give you some idea of the indignation excited against this article, I will quote the language of some of those who wrote against it. Old Burton, in his "Anatomy of Melancholy," a book of which the celebrated moralist, Dr. Johnson, says, it was the only book that ever took him out of bed sooner than he wished to rise, gives the following anathema against tobacco. "Tobacco, divine, rare, super-excellent tobacco, which goes far beyond all their panaceas, potable gold, and philosopher's stones, a sovereign remedy to all diseases. A good vomit, I confesse, a vertuous herb, if it be well qualified, opportunely taken, and medicinally used; but as it is commonly abused by men, which take it as tinkers do ale, 'tis a plague, a mischief, a violent purger of goods, lands, health: hellish, devilish and damned tobacco, the ruine and overthrow of body and soul."—Vol. ii. p. 109.

Another writer, Joshua Sylvester, wrote a poem on tobacco, which he dedicated to Villiers, Duke of Buckingham. This book was entitled "Tobacco battered, and the pipes shattered (about their ears who idly idolize so base and barbarous a weed; or at least-wise overlove so loathsome a vanity), by a volley of hot shot from Mount Helicon."—American Quarterly, vol. ix. p. 14. In this work the author questions whether the devil had done more harm in latter ages by means of fire and smoke, through the invention of *guns* or *tobacco pipes*, and he conjectures "that Satan introduced the fashion as a preparatory course of smoking for those who were to be matriculated in his own college."

King James I. of England wrote a formal treatise against it, entitled a "Counter Blast to Tobacco," in which he says the use of it "is a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs; and in the black, stinking fume thereof, nearest resembling

the horrible Stygian smoke of the pit that is bottomless." He states also that "if he should invite the devil to dine with him, he would among other things give him a *pipe of tobacco*, as particularly agreeable to him, to help digestion."

The Popes Urban and Innocent XII. both published edicts of excommunication against all those who took either snuff or tobacco. To restrain the cultivation of tobacco in Virginia, and to prevent its exportation into England, several arbitrary measures were attempted during the reign of James I. By some of the Swiss Cantons, smoking was considered a crime second only to adultery; and to cap the climax of severity against this poor plant, Amurath IV. made the use of tobacco a crime punishable with death. Still the fragrant weed flourished, and loyal subjects and devout Christians, sturdy republicans and slavish Asiatics, all, all resist the law and yield to the influence of tobacco.

Tobacco is an annual plant, growing about four feet high. It is planted in the spring, and flowers in July and August. At one time it was raised to a considerable extent in some parts of England. At present that country, as well as the greatest part of Europe, is chiefly supplied from the State of Virginia. It is cultivated also in every part of the East Indies and in the Eastern Islands. Of the species of tobacco known by the name of *Virginia tobacco* there are two varieties—a broad and a narrow leaved sort. They do not differ, however, in their properties. In cultivating the plant it is not allowed to attain its full height, but is *topped* whenever a certain number of leaves are thrown out. This is done to promote the development of the leaves, by preventing the formation of the flowers and seeds. It is cut down in the month of August, and the plants hung up in pairs under sheds to dry, after which the leaves are separated from the stem, bound up in bundles, and packed in the hogsheads in which they are exported. The part used are the *leaves*, which are about two feet long and four inches broad; when fresh they are of a pale green color, and when carefully dried of a lively yellow. Their *smell* is strong, disagreeable, and narcotic; their *taste* bitter and acrid.

The active principles of tobacco are a peculiar oil-like alkaloid called *nicotina*, and a camphoraceous volatile oil termed *nicotianin*. It is the first of these upon which the active power of tobacco depends. In 10,000 parts of the leaf, 6 parts of nicotina were obtained and 1 of nicotianin. The *empyreumatic oil* of tobacco, which as found in the pipe of the smoker, is an active poison, appears to be *nicotina* attached to a true volatile oil." [Christison.]

Nicotina is so active a poison that half a grain has been known to kill a dog. [Christison.]

Tobacco leaves yield their virtues both in *water* and alcohol—more so in the latter.

Effects.—These differ according to the *mode* of use and the object had

in view in its use. Its effects are local and general. The first are stimulant. If applied to the nostrils in the form of snuff, it causes sneezing and increased secretion from the nose. Taken into the mouth and chewed, or applied in the form of smoke, it stimulates the salivary glands and causes a flow of saliva.

Its general effects on the system are sedative and relaxing.

In large doses it is a virulent poison, acting principally on the brain and heart. It impairs the action of the heart, causing a sense of fluttering—excessive faintness—copious perspiration—sense of alarm—sickness and vomiting—coldness of skin—feebleness of pulse—convulsions and death. When used in medicinal doses, we give it simply for the relaxing effects which it produces, and particularly on the muscular tissue. It produces sickness—sometimes vomiting—relaxation of the bowels—lessens the force and frequency of the pulse—promotes the flow of urine, and causes general relaxation.

In the ordinary use of it as a *luxury*, it always causes in those unaccustomed to it deadly nausea, giddiness, and great prostration of strength. These effects are repeated probably several times on each successive trial. After a while, however, these unpleasant effects are no longer experienced, and then succeed those placid sensations which have given to this article charms so irresistible. By a person who uses it in the form of smoke these are particularly experienced; "an air of peculiar satisfaction beams upon his countenance; and as he puffs forth the volumes of fragrance, he seems to dwell in an atmosphere of contented happiness."

With regard to the effects of tobacco, it is important to recollect that they are modified by a number of circumstances.

1. The *quality* of the tobacco. It is well known that the strength of tobacco varies very much, according to the climate, etc., in which it is reared. In warm latitudes it is mild; in cold regions pungent and acrid. Bengal tobacco, I believe, is the weakest; next to this is the West Indian tobacco. Northern tobacco is the strongest. According to experiments, in 1000 parts of tobacco the following proportions of nicotina were found in different kinds of this article: 8·64 in Havana tobacco, 10·00 in Virginia, and 11·28 in some specimens grown in France. (See Christison's Dis.) The *soil*, too, makes a difference in its quality. In a virgin soil it is mild, while in one richly manured it is very rank. (Rogers, 58.)

2. The habits of the person also modify very much the effect of this article. Thus you all know, that if a person has been accustomed to the use of tobacco, he can bear quantities of it which under other circumstances would produce very unpleasant effects. From the mere force of habit, some persons can remain under the influence of tobacco in some shape or other from morning till night.

3. The age, sex, peculiar constitution, etc., also modify the effects. To children under four or five years it ought never to be given; it may prove

fatal to them. Females are much more severely affected by it than males. Persons of delicate and nervous constitutions, too, have their systems much more affected by it than the robust and strong. A great difference is observed according as the stomach is full or empty.

Tobacco acts upon the system in whatever way it is applied, whether by the mouth, rectum, lungs, skin, etc.

Mode of Administration.—As a medicine it is now never given except by the *anus;* as a luxury it is used by the *mouth.*

There are two forms in which this article is used as an injection—*smoke* and *infusion.* The latter is the mode generally resorted to, and can be better regulated than the smoke. As tobacco is so powerful a poison, great care should be taken in not giving the injection too strong. One drachm in this way has proved fatal, and sometimes even half a drachm has produced the same effect. As a general rule, therefore, the best plan is never to exceed fifteen to twenty grains infused upon a pint of boiling water, and draining. This will commonly produce sufficient of the relaxing effects without any of the poisonous ones. "If the injection does not come away in five minutes, it should be assisted by throwing up a large quantity of tepid water; and if its sedation be too great or lasting, such stimulants as ammonia and brandy ought to be administered." (Christison.) Sometimes it is used as a local application either in the form of *cerate* or a plaster made of snuff.

As a luxury, tobacco, as you know, is used in almost every form. Pulverized and manufactured into *snuff*, we have every variety, from the acrid Scotch to the more delicate rappee; of *cigars* we have all sorts and shapes and sizes; and of *tobaccos* time would fail me to tell of the short cut and the long cut, the coarse cut and the fine cut, ladies' twist and Virginia twist, pig tail, negro head, and the thousand other forms into which human ingenuity has tortured this article.

Of the Uses of Tobacco.—If tobacco in medicinal doses be the active article which it certainly is, it ought to be used with great caution. Like all articles of this kind, it ought to be reserved for such cases and emergencies as cannot be met by milder means, and such is the general judgment of the profession. There are cases, however, in which it has been used with advantage, where we require the profound relaxation which this substance produces. The class of cases in which it has been used with advantage are those in which muscular and fibrous tissue requires to be relaxed. Among these are *tetanus*, and *retention of urine* arising from spasmodic stricture of the urethra. Several cases are related by Mr. Earle, in which this succeeded where instruments could not be introduced, and where venesection and other remedies had failed. In ten or fifteen minutes after the tobacco enema, urine flowed. It is also used by the surgeons in cases of *incarcerated hernia.* Dr. Ainslee says the native practitioners in the East Indies are in the habit of applying the leaves warmed to the orifice of

the anus in obstinate constipation, and with uniform success in these cases. Applied in this way it generally vomits.

Formerly tobacco was used internally in dropsy as a diuretic. It is not used at present.

Externally applied it has been used to promote absorption in swelled breasts or buboes. The snuff plaster is still occasionally used in croup, but it should be carefully watched, as the constitutional effects may be dangerous even after their use.

With regard to the use of tobacco as an ordinary luxury, your opinion will be frequently asked when you get into practice. On this subject I need not tell you there is a great difference of opinion. By some it is denounced as always injurious. By others it is considered not merely innocent, but even salutary. As is generally the case, truth lies in the middle. If the use of tobacco were attended with the consequences attributed to it by some, in what a miserable condition would the poor human race be wasting away under a slow and deadly poison which they are taking in daily, and yet, lamentable to say, totally unconscious of it.

A good cause is never promoted by attempts to mystify the truth, and common observation settles the question that the moderate and daily use of tobacco *does not* prove injurious. This is as a general rule; constitutions, however, are seriously and insidiously injured by its moderate use, while to all its excessive use is unquestionably detrimental.

As the result of a good deal of observation, the conclusions to which I have come in relation to the use of tobacco are the following:

1. It is not necessary for man. The inhabitants of the old world, before they were acquainted with this article, enjoyed as vigorous health and lived as long as we do in the present day.

2. To some persons, and in certain conditions, it may prove salutary. I know a gentleman who consulted me about twenty years ago. He was plethoric, and was troubled with inordinate action of the arterial system, but otherwise well. I advised him to smoke moderately, and he is still living, and thinks he owes his life to the prescription.

3. To many it is positively deleterious. I am convinced that a large proportion of the *dyspepsias* which are prevalent are owing, as their remote cause, to the use of tobacco. It impairs the tone of the digestive organs, and renders the whole system nervous. To those predisposed to consumption, it is manifestly bad. This is a disease of debility, and everything that debilitates the system must be injurious.

4. To young people tobacco generally is injurious, and for a very obvious reason. Until a certain age, the human system does not receive its full growth and development. If a boy at the age of 14 or 15 begins to use tobacco and spit freely, it must retard his growth, and perhaps lay the foundation of serious disease.

5. It is idle for the moralist or the physician to engage in an indiscrimi-

nate crusade against the use of tobacco. The one may exhort and the other may command, but it will all be of no avail. It has become an artificial want, and people are not to be coaxed or blustered out of it. The physician, however, can do a great deal in preventing the abuse of it, and this he ought always to attempt. In every patient laboring under chronic disease this ought to be made the special inquiry and direction.

With regard to the comparative effects of chewing and smoking, I go decidedly for the latter. If a man smokes as a gentleman, he can only do it at certain seasons and in certain situations. There must be an intermission. But to chewing there is no limit or check. A man who chews may put a quid in his mouth when he wakes in the morning and keep it there till he goes to bed at night, aye, and all night too. In this way he is constantly kept under its influence. [Much might be said of my favorite pinch of snuff, but I forbear.—Ed.].

Colchicum Autumnale.—This is a small, perennial, bulbous plant, growing native in the temperate regions of Europe, where it is found wild in moist meadows. The common name is *the meadow saffron.* In this country its cultivation has been attempted, but without much success. The parts used in medicine are the *bulbs* and the *seeds.*

There are certain peculiarities attending the growth of this plant which are important to be recollected, as they throw light upon the effects of it as a medicine. At the time of flowering in the autumn, a new bulb begins to form on the side of the old one, which partly embraces it. As the new one increases, the old bulb gradually wastes away until the following May or June, when the one is perfected and the other entirely decayed. It is evident from this that the strength of the bulb must vary greatly at different seasons of the year. The proper period for gathering it in England is in June and August. If taken early in the spring the bulb is too young, and if taken late in the autumn the old bulb is exhausted by the new offset.

The mature bulb is of an ovoid shape, and about the size of a walnut. When fresh it yields, on cutting, an acrid, milky juice. When dried it is of a brownish color, with a deep groove running through it, and has no smell, but an acrid, bitter taste. Mr. Donovan thinks that drying the bulb interferes with its powers, and Dr. A. T. Thompson says, the acrimony on which its virtues depend is partially dissipated by drying and long keeping, and totally destroyed by a heat over 212°. Sir E. Howe recommends the wine made of the recent bulbs cut up while fresh, and immediately thrown into wine. As soon as dug up, it should be cut into slices and dried, otherwise it begins to vegetate.

The *seeds* are small, and when ripe of a dark brown color. They should be gathered when fully ripe and then dried. Their active properties reside in the husk. They should therefore not be bruised when used.

Chemical Properties.—All the virtues of the bulb are extracted by wine and vinegar.

Effects.—In its effects on the system colchicum is peculiar. It acts as a sedative to the nervous and vascular systems, and at the same time promotes secretion. If given in moderate doses it lowers the pulse and alleviates pain without producing any other manifest effect. If given in larger doses it causes nausea, vomiting, purging, accompanied with great prostration and depression of the pulse. Although placed by some writers along with diuretics, its action on the kidneys is very uncertain. According to the observations of Chelius, a curious effect is produced by it on the character of the urine, and that is to increase the quantity of uric acid. Thus, it is stated, that he found on the fourth day after using colchicum, the quantity of uric acid excreted was 0·069 parts; after four days using it was 0·076; eight days, 0·091; twelve days, 0·112, nearly doubling the quantity in twelve days.

In excessive doses it produces all the effects of a narcotico-acrid poison; where it proves fatal there is generally found inflammation of the stomach and bowels.

In relation to the use of this article as a medicine, there are two circumstances worthy of recollection. The first of these is the *uncertainty* which attends its operation. This, as has frequently been remarked, is owing to the difference in the strength of the bulb, from causes already noticed.

Another circumstance is that it sometimes acts very unexpectedly, with great activity on the system, and is attended with unpleasant, and even dangerous consequences. Dr. Armstrong accordingly lays it down as a rule to discontinue the use of it as soon as it brings on sickness or purging. In some cases, too, it produces profound languor and lassitude, without either sickness or purging. This, too, indicates that its use ought to be stopped, for the patient may sink in this state of collapse. Armstrong alludes to a case where death resulted in consequence of continuing the use of it after the purging and sickness had commenced. (Lectures, p. 354.)* In all cases, therefore, when a patient is under the use of this article he ought to be seen frequently and be carefully watched.

Forms of Administration. Substance.—The powder of the bulb in doses of from grs. iij to grs. v repeated about three times a day. Dr. Armstrong recommends that in this form it should never be used except in combination with an aperient. If sickness should occur, so much of the powder may be absorbed as to prove dangerous. He states that he saw one patient's life nearly sacrificed by inattention to this circumstance.

Acetum Colchici.—The vinegar of colchicum is prepared by macerating two ounces of the dried bulb sliced in two pints of vinegar, and then adding a fluid ounce of alcohol to preserve the preparation from decomposition. Dose from half a drachm to a drachm.

* See also Beardsley, p. 118.

Tincture and Wine.—From the variable strength of the bulb the only way is to prepare a saturated tincture or wine. Of these the dose is from half a drachm to a drachm repeated three or four times a day.

As the bulb is uncertain in its strength, the seeds have been lately used as a substitute. A tincture or wine is prepared by macerating an ounce of the seeds in a pint of Teneriffe wine. As the active properties reside in the husk, the seeds should not be bruised. The dose is from half to one drachm.

With regard to all the preparations of colchicum, Dr. Armstrong remarks, that by long keeping or exposure to the light they become more or less impaired in their virtues. Hence he advises them to be kept in a dark place, wrapped in paper or in opaque vessels. (Lectures, p. 353.)

Colchicum is not a remedy used in a great number of diseases. It is particularly celebrated in the treatment of gout and rheumatism, and in these it sometimes proves exceedingly valuable. It is supposed to be the active ingredient in the celebrated remedy for the gout, the Eau Médicinale d'Husson. In gout it sometimes produces relief without any sensible evacuation, acting simply as a sedative. Generally, however, you will find that the patient is not relieved until it acts on the bowels. In acute rheumatism it is advisable to bleed before prescribing the colchicum, although by some it is considered to be a substitute for the lancet. You will not find, however, this to be the case any more than with digitalis. Both are good adjuvants to bloodletting, but not substitutes for it.

Colchicum has also been used, and with some success, in inflammatory affections of the chest.

Aconitum Napellus.—This is commonly known by the name of *monkshood* or *wolf's-bane*. It is a perennial herbaceous plant, growing from two to six feet in height, and found abundantly on the mountains of Germany, France, and Switzerland. Until recently the part used officinally was the *leaves*. At present, however, the *root* is preferred as containing more of the active principle of the plant, and as more uniform in its strength.

The root at the thickest part is about the size of the finger, and from four to five inches long, with numerous fleshy fibres arising from it. When fresh its color is brownish externally and white internally. Its smell is earthy. Its taste is bitter. After being chewed it leaves a peculiar tingling and numbness on the tongue, lips, and fauces. The same effects on the mouth are produced by chewing the leaves. The root becomes of a darker color when dried.

Composition.—No very satisfactory analysis of the root or leaves has yet been made. They contain, however, a vegetable alkali, *aconitina*, a peculiar acid, *aconitic acid*, and a *volatile acid principle*. The alkali exists in the state of a salt, *aconitate of aconitina*.

Effects.—The effects of aconite are curious and peculiar. If a small quantity of the soft alcoholic extract be introduced into the cavity of the peritoneum of a dog, it usually causes vomiting, lessens the force of the circulation, impairs the muscular power so as to cause the animal to stagger, and destroys sensibility without causing stupor. The animal will sometimes follow its owner around the room, recognise him by wagging his tail, and yet be totally insensible to pinching, pricking with needles, etc. Before death slight tremors, but no regular convulsions, generally take place. (Pereira.) On the *human subject* the effects are the following. If the leaf or root be chewed, or a few drops of the alcoholic tincture applied to the lips, in a few minutes a sensation of *numbness and tingling* is produced in the part, which lasts for several hours. If the quantity taken into the mouth be somewhat large, the *throat and palate* become affected. Pereira describes the sensation "as if the velum and soft palate were elongated, and resting on the dorsum of the tongue. To relieve this, frequent attempts are made to swallow."

When small and repeated doses of the alcoholic tincture of the root are swallowed, they cause a sensation of heat and tingling in the extremities, and occasionally slight diuresis.

In poisonous doses, the characteristic symptoms are, *numbness and tingling of the parts about the mouth and throat, and of the extremities, vomiting, contracted pupil, and failure of the circulation.* Neither *convulsion* nor *stupor*, as a general rule, precedes death.

It lessens directly the sensibility of the nerves and impairs the action of the heart. It is perhaps, therefore, the purest *sedative* that we possess.

The principal use to which the agent has been applied is that of lessening morbid sensibility of the nerves, and as such it frequently proves very efficacious. In *neuralgic affections*, it is sometimes wonderful in its effects—a simple local application effecting a cure. In rheumatic affections too, unattended by inflammation, it frequently proves very useful. The best form of it in these cases is the tincture, locally applied.

About a century ago, this remedy was in great repute in a number of diseases, such as scrofula, phthisis, cancer, dropsy, etc. It was one of the drugs so highly recommended by Baron Storck of Vienna. After a while it went into disrepute, and it is only recently that its use has been revived. At present it is not supposed to be of much benefit in the diseases in which it was so much lauded by Storck.

Preparations.—The only preparations which ought to be depended on are the *tincture* and the *alcoholic extract* and *aconitine.*

Tincture.—See U. S. Ph.

Dose.—5 drops three times a day. To be used with caution. Applied externally by means of a small brush.

Alcoholic Extract.—U. S. Pha. $\frac{1}{6}$ of a grain every three hours, in pill.

Externally in the form of ointment, one part extract and 2 of lard, or spread on adhesive plaster.

Aconitine.—This alkali was first discovered in 1825 by Brande and Peschier.

It is obtained by taking the dried and bruised root of aconite and boiling it in rectified spirit three times successively. Then strain all the liquors and let the spirit distil. Evaporate what remains to the consistence of an extract. Here alcohol extracts the aconite from the root, and the extract contains this principle in combination with aconitic acid and other matters.

Water is then added to this extract, and the strained liquor is evaporated to the consistence of a syrup. The water here dissolves out the aconite from the extract.

To this diluted sulphuric acid and water are added. A *sulphate of aconitine* is thus formed, and this is again decomposed by the addition of a solution of ammonia, which precipitates the *aconitine.* In this state, however, it is impure. It is now to be again dissolved in diluted sulphuric acid and water, with the addition of animal charcoal. It is then to be strained, and the aconitine again to be precipitated by a solution of ammonia. It is then to be washed and dried.

Properties.—Aconitine is found either as a white granular substance, uncrystallizable, or in the state of a transparent, colorless mass, having the lustre of glass. It is destitute of smell and has a bitter and acrid taste. This acrid taste, however, does not belong to the aconitine, inasmuch as it can be separated from it by combining the base repeatedly with acids and decomposing the salt thus formed. Aconitine is little soluble in water, requiring 150 parts of cold and 50 of boiling water to dissolve it. In alcohol it is readily soluble. Aconitine combines with acids and forms salts. They do not, however, crystallize, but dry into a gummy mass. Their taste is very bitter. The solution of nitrate of aconitine is colorless. That of the sulphate is yellow at first, and afterwards becomes of a dark violet. The alkalies decompose them, precipitating the aconitine. (Phillips.)

Effects.—From the great activity of this article, it is not safe to use it internally. When pure, and deprived of its acrid principle, it appears to be the most virulent poison that we know of. The twentieth part of a grain dissolved in alcohol will destroy a bird with the rapidity of lightning. This was done with *Morrison's* aconitine. The fiftieth part of a grain of the same killed a sparrow in a few minutes (Phillips); and the same quantity nearly proved fatal to a female to whom it was given. (Pereira.)

If a grain or two of aconitine, mixed up with a drachm of lard or a drachm of alcohol, be rubbed on the skin of the forehead, or any other tender part for a minute or two, an effect is produced analogous to that of

veratrine and delphine. In some respects, however, the sensations differ. *Veratrine* "produces a strong sensation of tingling, or rather a sharp feeling, similar to that produced by receiving a succession of electric sparks on an uncovered part of the body." *Delphine* produces "a sensation of burning, not unlike that which manifests itself a short time after the application of a blister, but to an unpleasant degree." *Aconitine* produces "a sensation of heat and prickling;" to this succeeds "a feeling of numbness and constriction in the part, as if a heavy weight were laid upon it, or as if the skin were drawn together, by the powerful and voluntary contraction of the muscles beneath. This effect lasts from two or three to twelve or more hours, according to the quantity rubbed in." (Turnbull, p. 58.)

Aconitine produces less local irritation than either veratrine or delphine. Indeed, in no case does it produce any more local excitement than could be accounted for by the mere friction.

A minute portion of the ointment applied to the eyes causes almost insupportable heat and tingling, and contraction of the pupil. (Pereira.)

There are two forms in which this substance is used as an external application, *ointment* and *solution.*

Ointment.—This is prepared in the following way:

℞. Aconitine gr. ij.
Alcohol gtt. vi tere optime.
Et adde Axung. ℨi ut fit ung.

If necessary, it may be increased to the strength of four or five grains to the drachm.

This is to be rubbed on the part until the pain is relieved, and may be repeated three or four times a day, according to the effect produced.

With regard to the aconitine, the same rule holds good as with the veratrine. Unless it produces the peculiar effects of the article on the skin, no good need be expected from it.

Solution.—One or two grains dissolved in a drachm of alcohol. This may be applied by means of a small sponge brush.

Care should be taken in making these applications that the skin is not abraded.

Veratrine.—This vegetable alkali was first discovered in 1819, by Pellatier and Caventou, in the seeds of the *Veratrum sabadilla*, or the *Helonias officinalis*, a plant growing in Mexico. It was afterwards detected by them in the roots of the *Veratrum album* and the *Colchicum autumnale.* What is used in medicine, however, is obtained entirely from the *sabadilla* seeds.

Mode of obtaining it.—The seeds of the sabadilla bruised are first boiled in alcohol, and this is repeated three times. The alcohol here dissolves out all the *Veratrine*, along with *veratric acid*, *coloring matter*, and *other compounds.*

The alcoholic solution is then evaporated to the consistency of an extract. This is then boiled three or four times in water, to which a little sulphuric acid has been added. Here the veratrate of veratrine is decomposed, and converted into the *sulphate of veratrine.*

The solution is then evaporated to the consistence of a syrup. This is then saturated with *magnesia*, and afterwards digested with a gentle heat in alcohol. Here the magnesia decomposes the sulphate of veratrine, and sets free the veratrine, which is taken up by the alcohol. The alcohol is then distilled off. The extract which remains is then boiled in water, to which sulphuric acid and animal charcoal are added. To the strained solution ammonia is added, which throws down a precipitate, which is to be separated and dried.

In the latter part of this process, the sulphuric acid unites with the veratrine, while the charcoal abstracts the coloring matter; the ammonia then again decomposes the sulphate, and throws down the *veratrine.*

The article thus prepared is the one used in medicine. It is not, however, considered as the pure alkali. It is a compound consisting of *pure veratrine, sabadilla, resin of veratrine,* and *gum resin of veratrine.* (Pereira.)

Properties.—Veratrine is obtained in the form of a light brown or white powder, without smell; taste acrid and burning, and producing a feeling of numbness and tingling, when applied to the tongue. In water, it is very sparingly soluble, but sufficiently so to render the fluid acrid; in alcohol and ether, very soluble. It restores the blue color of litmus, reddened by an acid, and unites readily with acids, forming uncrystallizable salts. When heated, it melts, and has the appearance of wax, and on cooling presents a mass of a brownish transparent appearance; when ignited in the air, it is decomposed and totally dissipated.

Effects.—By Magendie, the following results were obtained by experiments made upon *animals.* A very small quantity injected into the nostrils of a dog caused instantly a violent sneezing, which lasted near half an hour. One or two grains thrown into the throat caused a free salivation, which continued for some time. The same quantity injected into any part of the intestinal canal produced inflammation of the part with which it came in contact, succeeded by vomiting and purging. In large doses, it caused great acceleration of the circulation and respiration, quickly followed by tetanus and death. One or two grains injected under the pleura or tunica vaginalis produced tetanus and death in ten minutes. The same quantity injected into the jugular vein caused similar effects in a few seconds. On dissection, the mucous membrane of the intestines was found inflamed, and the lungs engorged and inflamed.

In the *human subject,* the smallest quantity taken into the mouth causes free salivation, and if applied to the nostrils, produces violent sneezing.

When given internally in medicinal doses, a sensation of warmth is produced in the stomach, which gradually extends itself over the abdomen and lower parts of the chest, and afterwards to the head and extremities. If the medicine be continued, a sense of *tingling* is felt in different parts of the body, and sometimes over the whole surface, accompanied frequently by perspiration and a sense of oppression. To this succeeds a sensation of *coldness*, and if the medicine be still continued, nausea and vomiting take place; sometimes looseness and only occasionally purging are produced. Generally the force and frequency of the pulse are diminished under its use, but no narcotic effects take place. When applied *externally*, in the form of ointment rubbed on the skin, as a general rule, no local irritation is caused. In some cases a slight blister, and in others an eruption appear on the part. The first effect experienced is a sense of warmth and tingling in the part, and, according to Turnbull, *until this is produced, no effect is experienced from the medicine.* This is a good criterion to judge of the purity of the article. After the ointment has been applied a sufficient length of time to influence the system, the heat and tingling extend over the whole surface, and the same sensations are produced as those accompanying its internal use. The pulse is also affected as by the internal use. Applied *endermically*, the effects are still more decided, but the local irritation is so great as to preclude its use.

Form of Administration.—In consequence of its acrid taste, the best form of giving it is that of *pill.* The formula recommended by Turnbull is the following:

℞. Veratrine grs. ij.
Ext. hyoscam. grs. vi.
Pulv. rad Glycyr. grs. xii. M.
Divide into twelve pills—one three times a day.

Tincture.—Magendie directs four grs. to be dissolved in one ounce of alcohol. Of this he advises from ten to twenty-five drops to be given in a cup of broth as a substitute for the tincture of colchicum.

As *external applications*, it may be used either in the form of *ointment* or *tincture.*

The ointment is the best. This is made by rubbing up from fifteen grs. to ʒss veratrine, with ʒi olive oil and ʒi of lard. Of this a piece as big as a nut is to be rubbed with the hand for ten or fifteen minutes on the part affected. In doing this, care should be taken that the skin be not broken or denuded, otherwise great irritation will be produced. Where the ointment cannot be used, a *tincture* made of ʒi veratrine to ℥ij of alcohol may be applied in the same way.

Beside the alkali itself, the *tartrate*, *acetate*, and *sulphate*, have been used. They produce the same effects, and are given in the same doses.

Diseases in which Veratrine has been used.—The diseases in which it

has been used by Dr. Turnbull, and as he says with advantage, are: 1. Affections of the heart, unattended by organic disease; 2. Neuralgic affections. In these it seems to exert its power in the most striking manner. In some cases a single friction gives entire relief. 3. In chronic rheumatism; 4. Gout; 5. Dropsy. In this case it operates by promoting the flow of urine. In all of the foregoing cases, the remedy was applied externally.

Delphine.—This was discovered in 1819, by MM. Lassaigne and Fenuelle. It exists in the seeds of the *stavesacre.* (*Delphinium staphisagria* in combination with *delphinic acid*.

The mode of obtaining it, recommended by M. Couerbe, is the following:—a saturated tincture of the seeds is to be evaporated to the consistence of a thin extract, and heated with water acidulated by sulphuric acid. This solution, when filtered, is to be precipitated by ammonia. The precipitate after being freed from its water, is to be taken up with alcohol, and again reduced to the consistence of extract, which is likewise to be dissolved in acidulated water. To this solution, when filtered, a small quantity of nitric acid is to be added, as long as any precipitate falls. The liquid freed from this precipitate is again to be thrown down by ammonia and the powder dried. (Turnbull, p. 49.)

This is the delphine of commerce. Like veratrine, however, this is a compound substance, consisting of *delphine*, *resinous matter*, and *staphisacre* (an acrid resin). To obtain the delphine separately, dissolve in ether. This takes up the delphine, but leaves the others.

Properties.—When pure, delphine is in the state of a white powder, without smell, but has a bitter and acrid taste. It is very sparingly soluble in water, whether hot or cold. It nevertheless imparts its bitter taste to the water. In ether it is soluble, and still more so in alcohol. Its solutions in these fluids have the property of rendering syrup of violets green, and of restoring the blue color of litmus when reddened by acid. It unites with the acids, forming salts which are bitter and acrid, and crystallizes with great difficulty. When heated it melts and resembles wax in its appearance. On cooling it is brittle, like resin.

Effects.—In doses of half a grain, repeated three or four times a day, delphine may be given without producing any irritation of the stomach. In some cases it operates on the bowels, and most usually causes an increased flow of urine. When taken to the extent of a few grains, it gives rise to sensations of heat and tingling in various parts of the body, analogous to those produced by veratrine.

In large doses, it is a narcotico-acrid poison. The salts of delphine act in the same manner as the pure alkali.

When applied *externally*, in the shape of ointment or solution, it causes a sensation of burning, resembling very much the effect produced by a

blister a short time after it has been applied. In almost every case it causes a blush of redness on the surface to which it is applied. In this respect it differs from veratrine, which causes no redness. Besides this, the local effect of delphine is more permanent than that of veratrine.

Test of the goodness of Delphine.—Turnbull lays down the rule that unless a solution of it in alcohol, in the próportion of four grs. to the drachm, produce a sense of heat and pricking, after being rubbed on the forehead for three or four minutes, it is not good and ought not to be used.

Form of Administration.—Internally, it may be given in pill.

℞. Delphine, gr. i.
Extract hyoscyamus,
Extract glycyrrhizæ, āā grs. 12.—12 pills.

One to be taken every three or four hours.

It is generally, however, used as an external application either as *ointment* or *solution*, in the proportion of from 10 to 30 grs. to the ounce of lard or alcohol.

These are to be rubbed on in the same way as the veratrine, from 10 to 20 minutes, or until the peculiar tingling sensation is caused in the part, and this is to be repeated three or four times a day.

Diseases in which Delphine is used.—In its general effects, delphine resembles veratrine, and has been used in the same affections. Chiefly used in neuralgic affections, paralysis, and rheumatism.

Actœa Racemosa.—Known by various other names, as *Cimifuga racemosa*, *Cimifuga serpentaria*, *Macrotys racemosa*, and by the common names of *black snake root*, *cohosh*, *squaw root*.

This plant grows from four to six or eight feet high. It is found native in many parts of the United States from Canada to Florida. It flowers in June and July. The part used is the *root*, which is perennial. As found in the shops it consists of a rough tuberculated head, with numerous radicles, sometimes several inches long. These radicles are brittle, and easily separated. The color of the root is blackish externally and white internally. It has little smell, its taste is bitter and somewhat astringent, leaving a sense of acrimony on the palate. The proper time for gathering the root is late in the summer or in the autumn. Its sensible properties are said to depend a good deal upon the time of gathering, mode of drying, etc.

According to the analysis of Mr. Tilghman, it contains *fatty matter*, *gum*, *starch*, *resin*, *green coloring matter*, *tannin*, *wax*, *gallic acid*, *sugar*, *oil*, *lignin*, with salts of *lime*, *iron*, *magnesia*, and *potassa*.

The virtues are yielded to water and alcohol.

Effects.—In its general action on the system, this article appears to resemble very much the colchicum. It promotes the secretions of the mucous membrane, and at the same time produces an impression on the nervous system, and lowers the action of the heart and arteries.

It is very much used by many American practitioners in rheumatism, and is said very often to produce excellent effects. It has also been used in some nervous affections, as chorea. It had at one time great reputation in affections of the lungs, as humoral asthma, chronic bronchitis; it was even said to have *cured* phthisis. That it may do good in the former cases is probable; in the latter, certainly not.

Cold.—Cold is used in medicine to produce two very different effects, which may be called its immediate and its secondary effects. The immediate effects of cold are to depress vital action; it is one of the purest and most indisputable of sedatives; but cold is much more frequently used in the treatment of disease with a view to its secondary effect, or to the reaction which, when not too intense nor too long continued, it provokes. It is with the former of these uses of cold that we are now to deal.

Cold as a sedative is used either—

1. To reduce the temperature of the part to which it is applied, or of the whole system.

2. To repress vital action, especially the action of the heart and arteries.

The first of these uses of cold will be considered when I speak of refrigerants, and the use and value of the remedy appreciated; it is with the latter or the proper sedative effects of cold that we have now to do. Cold, then, is used to repress vital action in internal inflammations, especially of the brain; the mode of applying it is either by cloths wet with cold water, by ice applied to the head, or by freezing mixtures. As to the use of cold cloths, I remark that their value, and indeed their safety, depends altogether on the manner in which they are used. If the water used is quite cold, and the cloths are changed often enough to keep the heat of the part down, nothing but good can result; but if, on the contrary, the water be only moderately cold, and the cloths be allowed to remain on long enough to become warm, reaction takes place after each application, and the art of man could scarce contrive a more mischievous agent. This is a very great objection to the use of this agent in this way. Everything depends on the nurse, and she is not always a safe dependence.

Ice to the Head.—This is generally applied in a bladder; it is free from the objection which I have stated against cold cloths, and if decent care be taken it will always do good, and never harm. The only way, indeed, in which it can do harm, is by depressing the vital powers below the standard of life, and causing either fatal prostration of the whole system, or gangrene of the part to which it is immediately applied. To guard against this remember,

1. The class of patients most obnoxious to this kind of mischief are those whose powers are reduced, and whose capacity of generating heat is small. The two extremes of life present us with two illustrations of these states. The old man's powers are worn out, he resists cold badly, his circulation is languid, his extremities are more likely to give way under the

local effects of cold. On the other hand, the young child, and especially the infant, has but a moderate power of producing animal heat, and besides his vital powers are weak. He, too, resists cold badly.

But, aside from age, constitutions differ, and of course the feeble, the ill-nourished, the depressed, and those whose vital powers are failing under the influence of severe disease, will suffer most from intense cold. The rule to be observed for all these facts is simply to moderate the degree of cold which you use to persons who from age or constitution are ill able to bear up against it, and to watch the effect of cold applications in such patients, and indeed in all patients. With these guards the application of the ice poultice (so called) may be resorted to in inflammation of the brain with the best effects. The freezing mixtures are only to be used as substitutes for the ice bag. If it is desirable early in an attack to make a very strong impression on the cerebral circulation, this can be done by pouring from a height ice-cold water on the head. This is a remedy of great power, and should be used with caution. It is not proper where serious organic mischief is suspected. It must not be long continued (three to five minutes is enough).

2. Great care should be taken to prevent excessive reaction after the cold dash by immediately applying to the head either cold cloths or the ice bag, and keeping it there for some time, watching always its effects, and removing the ice if it seem likely to endanger the vitality of the scalp, or the vigor of the general system.

To Local Inflammations, the results of injury, cold water is an admirable remedy. Here the great art is to apply the cold in a moderate degree, but continue it for a very long time. This, however, belongs rather to surgery than to medicine.

Internal use of Cold as a Sedative.—This is resorted to in fevers, and especially in gastric inflammations. In fevers, cold water taken very freely is the form in which cold is best administered, because here you have with the sedative the action of that best of diuretics, water.

In Gastric Inflammations.—Here ice may be given, and with the very best effects; the feelings of the patient are the best guide as to the quantity, and it is very rarely necessary to put any restraint upon him in respect to what the Germans call ice pills. The most admirable effects often follow the *very free* use of ice and iced water.

In Puerperal Peritonitis.—When thirst is urgent the use of ice will do more than any other agent to quiet the distressing nausea and allay the burning thirst which add so much to the sufferings of the patient. Michaelis of Kiel has recommended the free application of ice in bladders to the abdomen, while ice was taken by the mouth. In his hands the practice was very successful.

REFRIGERANTS.

REFRIGERANTS are those agents which possess the property of lessening animal heat when preternaturally increased. They are sometimes called *Temperants*, from their lessening excitement. From the fact of their being used in inflammatory affections, they are sometimes also called *Antiphlogistics*. The term refrigerant is, however, perhaps the best. It is not my intention to go into any account of the various theories which have been offered in relation to the modus operandi of this class of agents. Ingenious as many of these are, they are nevertheless unsatisfactory.

The effects of refrigerants are simple and obvious. They lessen animal heat and moderate the action of the heart and arteries. It is to be observed, however, that they do this, if in any marked extent, only when the heat and circulation are above the natural standard. In the ordinary condition of the system they produce no very sensible effects. The individual articles of this class are not numerous, and they may be divided into three classes—1. Acids; 2. Salts; 3. Cold.

VEGETABLE ACIDS.

These possess refrigerant properties in a considerable degree. Those most used are the citric, acetic, tartaric, and malic. Most commonly these are not used except as they exist in certain vegetable productions in which they abound. These, therefore, will be briefly noticed.

INDIVIDUAL REFRIGERANTS.

LEMON.—This is the product of the *Citrus limonum*, or lemon tree, a native of Asia, and from thence introduced into Europe. It is now cultivated extensively in the south of Europe and in the East and West Indies. The Spanish lemon is considered the best. The juice of the lemon consists of, in 100 parts, *citric acid* 1.77, *malic acid*, *gum* and *bitter extractive* 0.72, *water* 97.51. The form in which this article is used is that of ordinary lemonade, and in that state it affords not only one of the most agreeable but valuable refrigerant drinks.

In combination with the bicarbonate of potassa it is used for the purpose of making the *effervescing draught*. A simple way of preparing this is to take ℥ ss of lemon juice, diluted with an equal quantity of water, and add to this a solution of 15 or 20 grs. of bicarbonate of potassa in ℥ ss of water. To be taken in the act of effervescence. Besides being refrigerant, this is a grateful stimulant to the stomach in cases of nausea and vomiting. It is also diaphoretic and diuretic. Here a citrate of potassa is formed, while the carbonic acid is diffused through the water.

THE ORANGE.—This is the product of the *Citrus aurantium*, a native of Asia, but cultivated in the south of Europe, in the West Indies, and in Florida. The juice consists of *citric acid*, *malic acid*, *mucilage*, *albumen*, *sugar*, *citrate of lime*, and *water*.

This is a most grateful refrigerant, allaying thirst and lessening heat.

CITRIC ACID.—This acid is peculiar to the vegetable kingdom, and was first obtained in the solid state by Scheele in 1781. It is found in the juice of many acid fruits, generally in a free state, but sometimes in combination with potash and lime. It is found in the fruits of the genus citrus, in the cranberry, whortleberry, gooseberry, red currant, strawberry, raspberry, cherry, mixed with equal quantities of malic acid. In the tamarind it exists both with malic and tartaric acids.

It is always obtained from the juice of the lemon and lime. It crystallizes in colorless rhomboidal prisms which are slightly affected by exposure to a moist air. It is exceedingly acid, but destitute of smell. It is soluble both in hot and cold water, and, in small proportions, in alcohol.

Citric acid answers as a substitute for lime juice when that article cannot be procured. Nine drachms and a half of the acid dissolved in a pint of distilled water form a solution equal in strength to recent lime juice.

Of this solution or of lemon juice ℈ j of bicarbonate of potassa saturates ʒ iij ss, ℈ j of carbonate of potassa ʒ iv, and ℈ j of carbonate of ammonia ʒ vi. A scruple of the acid dissolved in a pint of water, and sweetened with sugar which has been rubbed on fresh lemon peel, makes a good substitute for lemonade. U. S. Disp.

TAMARINDS.—This is the product of the *Tamarindus Indici*, a large tree growing native in the East Indies, Egypt, and Arabia, and from thence transplanted in the West Indies. In every part of India this tree is common, and in all the Eastern islands it grows luxuriantly. According to Ainslee, it is in Java that it attains the greatest perfection, and is an exceedingly beautiful tree. Vol. i. p. 426.

The fruit is a broad ash-colored pod, from two to six inches long, containing numerous seeds, surrounded by a viscid pulpy matter. Tamarinds are chiefly brought here from the West Indies, where they are pre-

pared by placing the pods, previously deprived of their shells, in layers in a suitable vessel, and then pouring boiling syrup over them. This congeals on becoming cool.

Fresh tamarinds have a pleasant acid taste, without any sweetness. As brought to this country they are in the form of a dark colored mass, with a sweet acidulous taste. According to the analysis of Vauquelin, the pulp of the prepared tamarind contains in 100 parts (besides the sugar which is added), *citric acid* 9·40, *tartaric acid* 1·55, *malic acid* 0·45, *supertartrate of potassa* 3·25, *gum* 4·70, *gelatine* or *jelly* 6·25, *parenchymatous matter* 34·35, *water* 27·55.

Sometimes copper is also detected in them. This is supposed to be owing to the vessels in which they are frequently prepared. This may easily be ascertained by inserting a smooth iron blade in them. If copper be present a reddish crust will form on the blade.

Effects.—Tamarinds are agreeably acid and refrigerant. If taken in sufficient quantities they also prove laxative. The common form of using them is that of tamarind water, made by infusing boiling water on the prepared pulp.

VINEGAR.—This is called *Acetum*, or the *Acidum aceticum impurum*, a peculiar fluid obtained from certain liquors undergoing the acetous fermentation. In wine countries it is obtained from vinous liquors, but in this country it is usually obtained from beer and cider. In its color, vinegar varies from a yellow to a deep red, according as it is prepared from white or red wine.

According to analysis, vinegar consists chiefly of *acetic acid* and *water*, in the proportion of five parts of the first to ninety-five of the second. Besides these, it contains various impurities derived from the liquors from which it is prepared, such as gum, starch, malic and tartaric acids, coloring matter, a little alcohol, and small proportions of alkaline and earthy salts.

Properly diluted, vinegar forms an excellent refrigerant drink, although not so agreeable as the other vegetable acids, and on that account not so much used. As an addition to gargles, it is frequently very useful as an astringent; as an external application, largely diluted with water, it is very valuable for sponging the surface, for the purpose of lessening morbid heat.—See Thomson, vol. i. p. 479.

COLD.—This is the most decided refrigerant that we know of; and in many cases is most advantageously applied in the management of disease. It may be applied in various ways. 1. In the shape of *Cold air;* 2. Cold water taken internally and externally; 3. *Ice* applied externally and taken internally.

PRACTICAL APPLICATION IN THE TREATMENT OF DISEASES.

1. Fevers.—Whatever difference of opinion may have existed at one time in relation to the use of refrigerants in febrile affections, scarcely any exists at present. That there ever should have been any doubt on the subject seems strange enough. If refrigerant agents possess the power of lessening morbid heat, moderating the action of the heart and arteries, and allaying thirst, one would suppose that common sense as well as reason would have sanctioned, if not suggested, the propriety of their use in fever. In the practice of the present day they are generally resorted to, and may be used with great advantage in all fevers, where the object is to diminish morbid heat and moderate the circulation. In many cases, too, they are the best remedies which can be used for the purpose of quieting irritability of the stomach. In some of the forms of fever in which this is a prominent system, besides the ordinary effervescing draughts, cold water and ice in small pieces are among our most efficient agents.

The history of the use of cold water in fever is very interesting. Among the ancients it was a practice by no means uncommon. It was used by Hippocrates; and Galen, who wrote extensively on the use of water, recommends in the highest terms the administration of cold drinks, and even immersion in the cold bath, in cases of ardent fever. The form of *affusion*, however, as practised in modern times, does not appear to have been known to them, and their practice, such as it was, seems never to have been established upon any scientific or philosophical principles. Accordingly, like all other remedies used empirically, it sank before the wave of varying opinions and successive theories, and eventually was completely lost in the medical practice of the civilized world. Among some of the ruder nations of Asia and Africa traces of it were, however, to be met with. Lavary, who travelled in Egypt, says it is customary for the inhabitants, when attacked with fever, to bathe in the Nile; and Bruce, the celebrated traveller, states it to have been common among the Abyssinians. The first regular and systematic notice that we have of the practice, however, was in the early part of the last century, by De Hahn, by whom it was extensively used in an epidemic fever of a typhoid character, which prevailed in Breslau, in Silesia, in the year 1737. The manner in which the water was applied was by means of "sponges soaked in cold water to every part of the surface in succession." In general, it was not resorted to until the eighth or ninth day of the disease, or when the case was becoming desperate from the failure of other remedies. Applied in this way, it must have frequently done more harm than good; at any rate, the practice made no progress.

It was reserved for Dr. William Wright, a British physician, who had

resided previously in the West Indies, to revive the practice. In the year 1777, while on his passage from the West Indies to Liverpool, he was seized with a fever which prevailed on board the vessel. Having tried various remedies, but without effect, and finding, too, that whenever he got upon deck he felt better, and that just in proportion to the coldness of the air, he determined, as he says, "to put in practice on himself, what he had often wished to try on others, in fevers similar to his own." Accordingly, on the fifth day of the disease, he pursued the following treatment, which I shall give in his own words:

"Sept. 9. Having given the necessary directions, about three o'clock in the afternoon I stripped off all my clothes, and threw a sea cloak loosely about me till I got upon deck, when the cloak was also laid aside; three bucketfuls of salt water were then thrown at once upon me; the shock was very great, but I felt immediate relief. The headache and other pains instantly abated, and a fine glow and diaphoresis succeeded. Towards evening, however, the same febrile symptoms threatened a return, and I had again recourse to the same method as before, with the same good effect. I now took food with an appetite, and for the first time had a good night's rest.

"Sept. 10. No fever, but a little uneasiness in the hams and thighs—used the cold bath twice.

"Sept. 11. Every symptom vanished; but to prevent a relapse, I used the cold bath twice."

Another person seized on board with the fever was treated in the same way, and with like success.

The account from which the foregoing is drawn was published by Dr. Wright in 1787 in the London Medical Journal; and it was this simple narrative which struck the eye of Dr. Currie, and suggested the hints which afterwards led to the ingenious and beautiful investigations of this subject by that elegant scholar and accomplished physician. Thus it is that men of genius, seizing the rude ideas of inferior minds, have constructed theories and perfected discoveries, which have rendered their names immortal.

Having received the commendation of such high authority, as might naturally be expected, the remedy became exceedingly popular, and was extensively used, more especially in hospital practice, by Drs. McLean, Jackson, and others. Undergoing the same vicissitudes which have so strikingly marked the history of our art, it has again fallen into disrepute. Believing it, nevertheless, to be a remedy of value, it may not be useless to designate the leading principles which should govern its use in fever.

1. It ought not to be used in the *cold stage* of fever. The internal organs are already in a state of oppression, and unable to react upon the blood thrown into them. In this condition of things the application of

cold to the surface will still further increase the oppression, and the consequence may even be fatal to the patient.

2. It should never be used when the heat of the system is not greater than natural. In judging of the degree of heat, it should not be determined merely by the feelings of the patient, but by actual measurement with a thermometer. For this purpose the bulb of a small thermometer should be placed under the tongue, or in the axilla. The heat in these two places corresponds exactly, and will indicate the heat of the surface of the body, where covered from the contact of the external air.

3. It should never be used when the patient is in a state of perspiration. The reason must be obvious. It interferes with a process which is most effectually lessening febrile heat and excitement, at the same time that it would drive the fluids upon the internal organs when they are not in a suitable condition for reaction.

4. It should never be used when local inflammation or congestion of some internal organ is present. Both would inevitably be aggravated by it.

5. It should never be used in the advanced stages of fever, where there is great debility, and where the heat of the system is already much reduced.

Under these restrictions this remedy may be used with great advantage in fevers, and the suitable period for it is when the exacerbation is at its height.

In continued fever this generally takes place towards evening. Generally speaking, it will prove most efficacious if used in the earlier stages of the disease.

In applying this remedy certain precautions are necessary. Salt water is preferable to fresh, as it produces greater reaction, and the temperature of it should be about 40°. The patient is to be placed on a stool in a large tub, and a bucketful of water is to be poured over his head and shoulders. He is then to be rubbed dry and put into bed. If the remedy agrees with him, it will be found in a short time afterwards that the heat is diminished, the pulse lessened in frequency, and indeed all the febrile symptoms are annihilated. If these effects should be produced, it may with safety be repeated whenever the febrile exacerbation comes on.

Such was the practice of cold affusions as recommended by Dr. Currie. At present it is but little used, and in place of it the safer and more convenient mode of applying cold in the form of cold sponging has been adopted. Used in this way it proves exceedingly salutary in allaying morbid heat, lowering the circulation, and soothing the patient.

Inflammations.—As a general rule, as has been already stated, the use of cold in cases of internal inflammations is objectionable. There are, however, two exceptions which require especial notice.

Phrenitis.—In cases of this kind, in addition to venesection, there is no remedy which exercises so powerful an influence as the application of cold to the head. It may be used in various ways—either by apply-

ing cloths dipped in cold water to the head, or by a common bladder filled with ice, or what is still more efficient, pouring cold water on it from a vessel. In using this the patient is to be raised in bed, and the body to be protected from being made wet. A large empty basin is to be held under the chin, and the cold water is then to be poured from a pitcher on the crown of the head, the stream to be raised gradually as the patient can bear it. This is to be continued until the desired effect is produced. This mode of applying cold originated, I believe, with Dr. Abercrombie, of Edinburgh. "Applied in this manner," he says, "it is a remedy of such power that it requires to be used with much discretion. Under the opperation of it I have seen a strong man thrown, in a very few minutes, into a state approaching asphyxia, who immediately before had been in the highest state of maniacal excitement, with morbid increase of strength, defeating every attempt of four or five men to restrain him.* The same remedy is recommended by Dr. Abercrombie in the convulsive diseases of children, in preference to the warm bath so commonly used.†

Gastritis.—This is another form of inflammation in which cold may be used with great advantage, taken internally. Small pieces of ice swallowed have frequently an admirable effect in allaying the gastric irritation.

[Intoxication and Narcotic Poisons.—To remove the effects of intoxicating drinks no agent can compare with cold affusion. I have tried this very frequently on men who were "*dead drunk*," unable to move; in ten minutes they walk about. It is, however, a remedy of very great power, and only to be used where there is vigor of constitution. In poisoning by opium, &c., it may be relied on with great confidence. I have again and again seen persons profoundly narcotized restored to sense and life by the continued use of cold affusion. It is, I am sure, not as frequently used, not as confidently relied upon as it should be.—Ed.]

* Abercrombie on Brain, p. 174.

† P. 175, also Tweedie, p. 146.

DEMULCENTS.

THIS class of remedies was by many supposed to act only mechanically by involving acrid matters in a mild and viscid coating, or by sheathing the surfaces to which they were applied, and thus protecting them from the action of irritants. This is an imperfect view of them. They do in fact act on the vital properties of the system, diminishing tone, relaxing and softening the tissues, and rendering them more flexible.

EFFECTS—*On the Mucous System.*—When taken by the mouth emollients, by their bland influence on the nerves of the mouth, pharynx, œsophagus, and stomach, produce a direct soothing influence on those parts, and also (probably by reflex action) a like effect on the bronchial mucous membrane. Hence their use in irritations and inflammations of any portion of the gastric and pulmonary membrane. [Is it not possible that demulcents may in the same way affect the vagino-uterine mucous membrane, relaxing its tissue and promoting secretion from it? If so the popular notion that these articles taken during the latter months of gestation facilitate parturition may be easily explained. I have generally attributed their effect (in the reality of which I fully believe) to their operation as laxatives.—ED.]

On the Blood and the Heart's Action.—The effect of demulcents must of course depend here, if not always, on the water in which they are taken; this would impoverish the blood and thus lower the heart's action, and diminish generally the tone of the system.

On the Urinary Organs.—Here again these agents act as purely diluents. They increase the amount and diminish the acridity of the urine. Oil and water are the only essential emollients. For though gum, starch, sugar, and gelatine are so termed, they do not act unless water be present.—Pereira.

INDIVIDUAL DEMULCENTS.

GUM ARABIC.—This is the product of the *Acacia vera* and *Acacia nilotica*, native trees of Africa, and found growing in almost every part of that continent. It is a spontaneous exudation from the bark of the trunk and branches. Sometimes the exudation is promoted by artificial incisions. When it first begins to flow it is soft and almost liquid, but by exposure

to the air it hardens into tears. In this form it is imported from Barbary and Morocco.

The sensible properties of gum arabic are by no means striking. When perfectly pure it is almost entirely destitute of color, or it has a pale yellowish hue. It has no smell, but a slightly sweetish taste, and is more or less transparent. It is hard, brittle, and easily pulverized, yielding a white powder. It has all the properties of pure gum; among these the following are the most important:—1. Completely soluble both in cold and hot water. In this state it forms what is called *mucilage*—when this is evaporated it yields the gum unchanged. 2. In alcohol, ether, and the oils it is insoluble. 3. By trituration with the oils volatile and fixed it renders them miscible in water.

As sold in the shops, gum arabic is frequently mixed with another gum, the *gum senegal*, the product of the Acacia senegal, a tree growing in the forests of Africa, in the neighborhood of the Senegal. In its general properties this gum does not differ materially from the gum arabic. It comes in larger pieces and is of a reddish color. It is, however, nearly as pure as the gum arabic, and in its medicinal properties is little if at all inferior.

Purity.—Gum senegal is frequently substituted for gum arabic. This may be distinguished by the gum senegal being *clammy* and *tenacious*, while the gum arabic is *dry* and *brittle*. This is a fraud, however, of no great importance in a medical point of view.

Sometimes it is mixed with the gum which exudes from the plum and cherry tree. This is much inferior to the gum arabic and gum senegal. It is distinguished from gum arabic by being, like tragacanth, insoluble in water, whereas gum arabic and gum senegal are completely soluble.

In the form of *powder* as sold in the shops, gum arabic is generally adulterated. The articles used for this purpose are *starch*, *wheat flour*, and *sulphate of lime*.

Tests.—1. Take a little of the suspected article and shake it in a vial, with the addition of cold water. The gum will dissolve in the water, and if there be any of the preceding articles present, they will fall to the bottom.

2. Boil the gum in water—add a little nitric acid and then a few drops of a solution of iodide of potassum. If starch be present it will strike a blue color.

3. Mix a little of the article with water into a dough. Fix this to the end of a platinum wire and subject it to the flame of a blow-pipe. If it does not burn away, but leaves anything behind, it is adulterated. (See Dom. Chem.)

4. If the suspected article be mixed with the powder of plum and cherry tree gum, it makes a ropy solution. Gum arabic makes a clear pellucid solution.

Effects.—Gum arabic is one of the most common and best of the demulcents. By some it is supposed to be positively sedative in its action upon irritated and inflamed surfaces. It is also neutritive, although this is positively denied by some. Experiments to ascertain this were made by Magendie, upon dogs, who were confined to the use of this article. In the second week they became emaciated and debilitated, and finally died of marasmus. In opposition to this, however, there are other facts which show that it cannot be so entirely destitute of nutritive properties. Haselquist, in his "Voyages in the Levant," gives an interesting account of a caravan travelling from Ethiopia to Egypt in the year 1750, which, during their long journey across the deserts, fell short of provisions. In searching among the merchandise which they were carrying to Cairo, they fortunately found a quantity of gum arabic, and upon this alone more than a thousand persons subsisted for the space of two whole months. Lind also states that the gum senegal or arabic serves as a sustenance for whole negro towns during the scarcity of other provisions occasioned by a failure of the crops of millet and rice; and the Arabs who twice a year collect this gum in the inland forests on the north side of the river Niger, have no other provisions to live upon for some months. Gum arabic, therefore, may be considered nutritive as well as demulcent.

Mode of Administration.—Generally used in the form of solution; one ounce of the gum to a pint of boiling water and suffered to cool. Also in the form of *syrup*, by taking of gum arabic ℥iv, sugar ℔ i, boiling water a pint. Dissolve the gum in the water; add the sugar and boil to the consistence of a syrup. Also in the form of lozenges.

Tragacanth.—This substance is obtained from different species of *Astragalus*, but chiefly from the *Astragalus verus*. This is a shrub growing two or three feet high, and is a native of the north of Persia. The gum exudes spontaneously from the stem and branches in the heat of summer, and is suffered to dry on the plant before it is collected. It comes in small wrinkled pieces of a whitish color, without smell, and has a slightly viscid taste. Although considered as a gum, it differs from this class of substances in the degree of its solubility in water. When put into water, it imbibes a large quantity of that fluid and swells, but does not dissolve nor form a fluid homogeneous mixture. It is turbid, and on standing separates from the water and settles down. In alcohol, it is like gum, insoluble. The principal peculiarity of this substance is the power which it possesses of giving viscidity to water, this being much greater than that of the gums. It possesses this in a degree twenty-four times greater than gum arabic. It is on this account that it is so much used in pharmacy to give consistency to the manufacture of pills and troches. "It appears to be composed of two different parts, one soluble in water

and resembling, though not identical with gum arabic; the other swelling in water but not dissolving." (U. S. Disp.)

Effects.—Demulcent and nutritive, though difficult of digestion. In consequence of its great insolubility not much used internally. Principally used in pharmacy.

Liquorice.—The plant which yields this is the *Glycyrrhiza glabra*, a native of Syria, Barbary, and the south of Europe. It is cultivated, also, in all parts of Europe. In the north of Spain, it is raised to a great extent as an article of commerce. That which grows in Spain is considered the best, containing a larger proportion of saccharine matter. The plant grows about four or five feet high. The part used is the *root*, which is dug up when the plant is about three years old. It is long and flexible, and about the size of the little finger; externally of a brownish color and yellow internally. It is without smell, and has a sweet, mucilaginous taste. If chewed with the bark on, it leaves a slight degree of bitterness in the mouth.

Composition.—According to analysis, liquorice contains *glycyrrhizine*, *starch*, *asparagin*, *resinous oil*, *albumen*, *lignin*, and *salts*.

The *glycyrrhizine* is a modification of saccharine matter, scarcely soluble in cold water, but readily so in boiling water, and differing also from common sugar in not being capable of undergoing fermentation. The *resinous oil* is bitter, and it is to this the slight degree of acridity which the root possesses is owing.

The *extract* is prepared from the root in the following way. The roots, dried and cleaned, are cut into small pieces and then boiled in water until the liquid is saturated. After the dregs have subsided it is poured off and evaporated to a proper consistence, when it is formed into rolls about five or six inches long and an inch in thickness. These are then dried and covered with leaves. In this state it is imported from Spain and Italy. When pure it is very black, dry, and brittle, with a glossy fracture and sweetish taste. In water it is completely soluble.

Purity.—The roots are frequently worm-eaten and decayed. Those are the best which have the brightest yellow color internally and when the layers are distinct.

The *extract* is very apt to be adulterated with various articles, such as *starch* and *sand*. It sometimes also contains a little copper.

When pure the extract ought not to become moist when exposed to the air in a dry place, and it should dissolve in water without leaving any residue.

What is called *refined liquorice* is nothing more than the foreign extract dissolved in water and the solution filtered and inspissated; this is then usually made up into little sticks called the *pipe liquorice*. When this is adulterated with *starch* it dissolves only partially in cold water, and

immediately deposits a dirty white powder possessing the properties of starch. When mixed with *carpenter's glue* it gives out ammonia, when heated in a glass tube or before the blowpipe.

Effects.—Liquorice is an excellent demulcent article, admirably adapted to allaying irritations of the mucous membrane in various parts of the body. Hence it has been used with great advantage in catarrhal affections, and irritations of the urinary organs.

Of the root the best preparation is the *decoction*, made by boiling ℥i of the root in a pint of water for about ten minutes. As the bark is acrid this should be taken off before it is boiled.

The extract may be taken either in the solid form or in solution, or in the form of lozenges.

Marsh Mallows.—This is the *Althæa officinalis*, a plant growing in Europe, on banks of rivers and in marshy places, from which circumstance it derives its name. It grows to the height of four or five feet, and the part used is the *root*. When prepared for the market the epidermis is taken off. It is of a whitish color, destitute of smell, and has a viscous mucilaginous taste. Every part of the plant abounds in *mucilage* and *starch*, besides *sugar*. It also contains a peculiar principle which has been called *althein*, but which is identical with *asparagin*.

Effects.—An excellent emollient and demulcent, and in general use as such in France and in Europe generally.

It is used in the form of *decoction* and *syrup*. In this country it is not much used, being considered inferior to gum arabic.

Jujube.—The tree yielding the jujube is the *Rhamnus zizyphus*, and is cultivated in the south of France, in Spain, and in Italy. The part used is the fruit. This is of an oval shape, about the size of an olive, and of a reddish color. Internally it contains a yellowish mucilaginous pulp, with a sweetish and acidulous taste. It is demulcent and nutritive. If taken to any extent it proves laxative. It is used in the form of decoction.

The *jujube paste* which is so commonly sold in the shops consists of gum arabic and sugar, dissolved in a decoction of this fruit and evaporated to a proper consistence. The preparation, however, very seldom contains any of the jujube.

Slippery Elm Bark.—The tree which yields this is the *Ulmus fulva*, the *red elm* or *slippery elm*. It is a lofty tree growing to the height of 50 or 60 feet, and is indigenous in this country, more particularly in the Northern and Western States.

The part used in medicine is the *inner bark*, from which the epidermis has been removed. It comes in long flat pieces of a fibrous texture, with a sweetish and mucilaginous taste when chewed.

It contains *fecula*, *gum*, and *ulmin.* It abounds in mucilaginous matter, and by infusion or gentle boiling in water it is readily dissolved and forms an insipid mucilaginous fluid.

Effects.—This substance is highly demulcent and nutritive. In times of scarcity the Indians are said to live upon it. Another use made by them of it is to facilitate labor. According to Mr. Rafinesque it is "a specific to procure easy labor to pregnant women by using the tea for two months previous, well known to Indian women, whose easy parturition has often been noticed." Med. Flor. vol. ii. p. 271. It is also somewhat diuretic.

Mode of Administration.—The common form is that of *infusion* made by macerating an ounce of the bark in a pint of boiling water. When ground into powder it makes a kind of flour, which mixed with boiling water makes a mucilage. Sweetened this makes an agreeable demulcent drink.

The powder made into a poultice is an admirable local application.

Benne.—The plant which yields this is the *Sesamum orientale*, a native of the East Indies and Africa. From the latter region it was introduced by the negroes into the West Indies and the Southern States, especially Georgia and South Carolina, where it succeeds very well. In this latitude it grows very well, but never comes to seed. It is an annual plant, about three or four feet high, and yields a small, yellowish seed, which is particularly valuable for the quantity and quality of the oil which is obtained from it. It is said that by expression ninety per cent. of this oil is obtained from the seeds, a larger proportion than that yielded by any other known vegetable, and of a quality fully equal to the common olive oil. By the negroes the seeds are used as an article of food, boiling them with Indian corn, &c.

The *oil* is without smell, of a sweetish taste, and can be kept a long time without becoming rancid. In China and Japan it is used in cooking and as an article of food. Its properties are very analogous to olive oil, and like that in suitable quantities proves laxative.

The part used in medicine is the *leaves.* These abound in mucilaginous matter, which is readily imparted to water.

Effects.—Emollient and nutritive. The oil is laxative, and is sometimes used as a substitute for castor oil.

Mode of Administration.—One or two of the fresh leaves stirred in half a pint of cold water in a short time form a thick viscid mucilage, which is used with much advantage in bowel affections, particularly of children. It may be drunk freely. When the leaves are dried boiling water is required.

Flaxseed.—This is furnished by the *Linum usitatissimum*, a well

known plant, supposed to have come originally from Egypt, but now found in almost all parts of the world. It grows about two feet high. The part used in medicine is the *seeds.* These have a mucilaginous and somewhat sweetish taste, and are destitute of smell. They consist chiefly of *mucilage*, of which they contain a large proportion, and a *fixed oil* (linseed oil); the former residing in the cuticle, and the latter in the nucleus or parenchymatous portion of the seeds. The oil is obtained by expression from the seeds in the proportion of about one sixth of their weight. The cake which remains after the expression of the oil is ground up and makes the *linseed meal.* As this contains all the mucilaginous part of the seed, it is highly nutritive and is used as food for cattle.

Effects.—Flaxseed is emollient and demulcent, and is also nutritive.

The seeds, reduced by means of a mill to a soft farina, are used in many parts of Asia as an article of food, mixed with honey. At Lacedemon it is said to have been used as food for the Helots. In times of famine in Holland it has served as sustenance, and it is stated that the French soldiers in their retreat from Moscow fed upon the cataplasms of this substance previously used for the sick.

Linseed *oil* is laxative.

Mode of Administration.—The ordinary form of using it is the *infusion*, made by digesting ℥i of the seeds in two pints of boiling water. The hot water extracts the mucilage from the cuticle without any of the oily matter. To make it more agreeable ʒj or ʒij of bruised liquorice root is added.

The meal is used for making poultices. The principal use of the oil is as a local application to burns, mixed with lime water.

Barley.—This is the product of the *Hordeum distochon*, a native of Tartary, but cultivated in different parts of the world. The parts used are the *seeds* or *grains.* When the seeds are deprived of their husks, they are called *hulled barley;* when deprived of their husks, and afterwards rounded and polished, which is done in a mill, they are called *pearl barley;* when the pearl barley is ground into a meal, it is *patent barley.*

Barley contains a large proportion of starch—67 in 100 parts. Besides this sugar, gum, gluten, albumen, &c.

Effects.—Highly demulcent and nutritious. The husk is slightly acrid and laxative. The pearl barley, therefore, ought to be used.

Form.—The usual form is that of *decoction*, or, as it is called, *barley water.* The mode of preparing this is important, and it is directed in the Pharmacopœa. Take two ounces of pearl barley, and wash with cold water, so as to clean it well, then pour on half a pint of water and boil for a little time, and throw away this water. The object of this is to purify it still more, and remove any mustiness or other unpleasant flavor which it

may have acquired. Then add four pints of boiling water, and boil down to two pints and strain. This may be flavored with sugar, lemon, &c.

Oatmeal.—This is obtained from the *Avena sativa*, a plant cultivated in every part of the world. The seeds, when deprived of their husks, are called *groats;* then when crushed are called *Embden groats.* (Pereira.) By simply grinding the seeds, the *oatmeal* is obtained.

According to the analysis of Vogel, 100 parts of *oatmeal* contain 59 of *starch*, 8·25 *sugar*, 2·50 *gum*, 2 *fixed oil*, 4·30 *albuminous matter*, 23·95 *fibrous matter.*

Dr. Christison makes seventy-two per cent. of starch.

Effects.—Oatmeal in the form of gruel is emollient and nutritious. It proves somewhat laxative to the bowels..

Oatmeal gruel is prepared by boiling one ounce of the meal with three pints of water to a quart, constantly stirring it. Then strain; let it stand till it cools, and then pour off the clear liquor from the sediment. It may be flavored with sugar, lemon juice, &c. It is frequently used after giving cathartics, also for enemata. The meal makes an excellent poultice.

Indian Meal.—This is obtained from the *Zea Mays*, *Maize*, or *Indian Corn.* This contains seventy-seven per cent. of starch, but no gluten. It is demulcent, and highly nutritive. In the form of gruel it is used as a substitute for *oatmeal.*

Rice.—This is the *Oryza sativa*, an annual plant coming originally from the East Indies, but now cultivated in various parts of the world. The rice of commerce consists of the *seeds* deprived of the husk.

According to Braconnet, it contains in 100 parts 85·07 *starch*, 3·60 *gluten*, 0·71 *gum*, 0·29 *sugar*, 0·13 *fixed oil*, 4·80 *vegetable fibre*, 5·00 *water*, 0·40 *saline substance.*

Effects.—Demulcent and highly nutritive. It sits easy on the stomach, and from the fact that after its digestion a very little residuum is left, it is considered astringent to the bowels. In the form of *rice water*, it is an excellent drink in irritation of the bowels with diarrhœa, &c. This is made by boiling two ounces of rice in two quarts of water for about an hour and a half. To this sugar may sometimes be added.

Arrow Root.—The plant which yields this is the *Maranta arundinacea*, a native of South America and the West Indies. It is also cultivated in the East Indies, in Florida, and the southern parts of the United States. It is perennial, growing two or three feet high. It derives its name from the fact of the native Indians applying the mashed root to the wounds of their arrows. The part used is the *root:* this is tuberous and fleshy,

and from six to twelve inches in length. The mode of obtaining the arrow root is the following.

The tuberous roots are dug up when about a year old, washed, and then beaten in wooden mortars to a pulp. This is then thrown into water and well stirred, for the purpose of separating the amylaceous from the fibrous part. The fibrous part is then wrung out by the hand and removed. The milky liquor which remains is then strained through linen, which, on standing, deposits a white mass. The water is drained off, and the mass again mixed with clean water and drained.

The mass which remains is then dried on large sheets in the sun. This is the arrow root of commerce. It is in the form of a white powder or small granular masses, producing a slight crackling noise when rubbed between the fingers. It is without smell or taste. Examined by the microscope, it consists of oblong or irregularly-shaped convex particles, with small mamillary processes upon the surface. Under the action of boiling water it forms a jelly, and this is the state in which it is used.

Arrow root is a pure starch, similar in its chemical constitution to wheat starch.

Purity.—Arrow root is frequently adulterated with *wheat* and *potatoe starch.* Although in a medicinal point of view there is little difference between these articles, yet it is important to be able to detect the fraud.

"Arrow root is not so white as the two other kinds of starch, but its grains are much finer, and when examined by a magnifying glass, appear pearly and very brilliant. Moreover, true arrow root always contains a great number of little clots, which are formed by the aggregation of the minute grains during the operation of drying. These clots crumble with ease when bruised with the fingers. Finally, the jelly which arrow root produces with water has no odor, while the jellies which are formed by wheat or potato starch are characterized by an odor at once powerful and peculiar."

Effects.—This is an excellent demulcent. In this quality it is supposed to excel all the other feculæ. It is also nutritious, and constitutes an excellent article of diet in certain cases. On the bowels it is an astringent.

The ordinary mode of preparing it for use is first to make a paste of the powder, with cold water, and then adding boiling milk or water and stirring briskly. In this way it speedily forms a clear jelly, which, according to the circumstances of the case, may be qualified with sugar, lemon juice, or wine. A tablespoonful of the powder will answer for a pint of water.

Sago.—This is the product of the *Cycas circinalis*, a species of palm tree very abundant in the East Indies. It grows to the height of twenty or thirty feet, and the trunk contains a large quantity of spongy medullary matter. It is from this that the sago is obtained. At a proper season, the tree is cut down and divided into pieces and split. The medullary

matter is taken out and reduced, by beating, to a powder. This is mixed with water and afterwards strained through a sieve. On standing the fecula subsides and the water is separated. It is dried in the form of *meal*, or made into *cakes*. This is the form in which it is used by the natives. For exportation the meal is made into a paste with water and then rubbed into grains. By the Chinese of Malacca, it is prepared so as to give the grains a pearly appearance. This is what is called the *pearl sago*. A single tree is said to furnish five or six hundred pounds of sago.

Pearl sago comes in small hard grains, about the size of a pin's head, of a pinkish color, without smell and very little taste.

In its chemical composition it is analogous to starch. In cold water it is insoluble. In boiling water, it is soluble, but less so than other feculæ. If the grains be put into boiling water they become soft and swell, still, however, retaining their form. It makes a perfect jelly only when the grains have been previously pulverized.

Effects.—Sago is not used except as food. If properly prepared, it forms a light, excellent article during convalescence, and in cases where you wish to give some support to the system without the stimulating effects of stronger food. Unlike arrow root it is laxative to the bowels. The proper mode of preparing it is to boil it thoroughly in water or milk. Then strain it so as to separate the grains which may be undissolved, and to this may be added sugar, nutmeg, and wine, according to circumstances. A tablespoonful will answer for a pint of water.

Tapioca or Cassava.—This is another fecula analogous to the two preceding. It is yielded by the *Jatropa Manihot*, a tree generally supposed to be a native of South America, but according to Abbé Raynal, brought originally from Africa by the negroes. According to Anslie, it also grows in many parts of India, and from it tapioca was obtained by him. It is cultivated extensively in Brazil and the West Indies. Tapioca is obtained from the root of the plant. This is first washed and scraped or ground into a pulp, which is then subjected to pressure to separate the juice. This juice, on standing, deposits a powder, which after washing with cold water is nearly pure fecula. This, when dried without heat, is in the form of a powder and resembles arrow root; when dried on heated plates, it assumes the granular form in which we have it.

The compressed pulp is dried and ground and forms a kind of meal, which is called *cassava meal*; from this the *cassava bread* is made, which is eaten by the negroes.

The root consists chiefly of *starch* and a *white milky poisonous juice*. If eaten in the raw state the root is highly poisonous. By the processes just described this is separated. As the poisonous principle is volatile, what remains of it in the meal is dissipated by heat.

Tapioca comes generally in the form of hard, white, irregular grains,

sometimes in the form of powder. It is called Brazilian arrow root. It has a slightly sweetish taste. In cold water it is only partially soluble. In boiling water it readily forms a jelly, which is inodorous, transparent, and insipid.

Purity.—An artificial tapioca is made from wheat and potatoe starch. When heated with boiling water this makes a jelly which is opaque and has the peculiar odor of wheat and potatoe starch.

Effects.—Demulcent and nutritious, resembling in their properties arrow root and sago. Prepared with boiling water it forms a jelly, and in this way is used like the preceding articles as an article of food, with the addition of sugar, lemon juice, &c.

SALEP.—This is obtained from the *Orchis mascula*, and other species of the same genus. It grows in various parts of Europe and Asia. In the East it is extensively cultivated, and is very much used as an article of diet by the inhabitants of Turkey, Persia, and Syria. The part used is the root. This consists of two bulbs of an oval shape and white color. They are prepared for use by rubbing off the epidermis, putting them in hot water and then drying them.

Salep comes in small, oval, irregular masses of yellowish color and horny consistence. They have a mild, mucilaginous taste, with a slight odor. Sometimes it comes in the state of powder.

Purity.—In the state of powder it is very apt to be adulterated with a factitious salep made from potatoes. These are peeled, cut into slices, baked until they become brittle, and then ground into powder.

Effects.—Demulcent and nutritive. It is supposed to contain a greater quantity of vegetable nourishment in a smaller compass than any other substance. It has accordingly been recommended as a valuable article for long voyages, &c.

NARCOTICS.

THE term *Narcotic* literally means an agent which possesses the power of producing torpor and insensibility. Various other terms have been applied to the articles usually ranged under this class. They have been called *Sedatives*, from their repressing action—*Anodynes*, from their relieving pain—*Hypnotics and Soporifics*, from their inducing sleep. Of all these the term narcotic is the best, as being the most general and descriptive. They may be defined to be those substances " which first excite and then diminish nervous action, and in appropriate doses stupefy."—(Dunglison.) They are distinguished from all other agents by the primary and special influence which they exert over the brain and nervous system.

Effects.—As the effects of these agents will be fully exemplified when we come to treat of opium, the present description will be purposely brief. There is no class of agents which differ more in their effects according to the dose in which they are taken. In very small doses, they appear to exert scarcely any action except a local one, diminishing the sensibility and irritability of the part with which they come in contact. When given in larger doses, their first effect is to excite the nervous and vascular systems. The energy of the brain is increased, and the pulse is moderately quickened. This effect takes place in a few minutes after the administration of the narcotic. After a short time a state of diminished sensibility succeeds. The influence of external agents is lessened, the pulse becomes slower, and a general languor overcomes the system. Then follows insensibility and sleep. With regard to the power of producing sleep, it is to be observed that all narcotics do not possess it equally. Some have it in an eminent degree, while others, if they possess it at all, do it only by the relief which they afford from pain and irritation. On the digestive organs the effect of narcotics is to impair the tone of the stomach, diminish secretion, lessen the appetite, and to interfere with the process of digestion. On the intestines they differ in their operation. Some, opium for example, constipate, while others, hyosciamus, stramonium, and the hop, relax the bowels.

In *very large* doses, narcotics prove poisonous, and to the state of the system which is induced, the general term of *narcotism* is applied. This state is characterized by a perverted and prostrated condition of the brain and nervous system. It comes on with giddiness and heaviness of the

head. The energy of the brain being impaired, that organ loses its controlling power over the rest of the system. The sight, the hearing, and all the senses are perverted. The mind loses its power—stupor or delirium supervene. The muscles are relaxed or convulsively agitated. Finally deep sleep benumbs the whole system, succeeded by coma and death.

With regard to the effect of narcotics there are two or three modifying circumstances of importance which ought to be borne in mind. These are the *age* of the subject, the fact of the system being accustomed to their use or not, and the actual condition of the system as to health or disease.

Age.—From the great delicacy and susceptibility of the nervous system in children, the impression made by narcotics is proportionately much greater in them than in adults. Unpleasant effects, therefore, not unfrequently occur in them from the smallest quantities. In early life, therefore, narcotics are to be looked upon as uncertain agents, and to be administered with great circumspection, especially as it regards the dose.

[This is a caution which cannot be too often repeated.—Ed.]

The *repeated or habitual use* of these agents has a wonderful influence in modifying their effects; and the general law of the system in relation to them is, that repetition of them gradually impairs their effects. Larger doses, therefore, can be continually borne, and to produce the same effect larger quantities are required to be given. This is remarkably the case with opium. It does not follow from this, however, that when the system has become habituated to one narcotic, it is so to all others. The contrary, indeed, is the fact. A person, for example, who has become accustomed to large doses of opium, may still be affected by moderate doses of other narcotics.

The *actual state of the system as to disease* greatly modifies the effect. In certain diseased conditions, immense quantities of opium and other narcotics can be given with perfect impunity; nay, with benefit; quantities which in the ordinary state of the system, would inevitably prove fatal.

There are certain conditions of the system in which the use of narcotics is *contra-indicated.* From the primary stimulant operation which they produce, as well as from the determination which they cause to the brain, they are not advisable where great plethora exists, or where inflammation or active determination to the brain is present. For the same reason where high inflammatory or febrile action is present, and the bowels are costive, they are contra-indicated. In all these cases, if their use be deemed necessary, it should be preceded by depletion and evacuants.

The uses to which narcotics are applied in the treatment of diseases are various and important. They are used:

1. To make a powerful impression on the nervous system, with the view of breaking up morbid action. For this purpose they are resorted to in diseases characterized by paroxysms, and in intermissions.

2. They are used to procure sleep.

3. To allay pain.
4. To allay irritability of the system depending upon exhaustion.
5. To control spasm.
6. To restrain excessive secretions.
7. To repress convulsive reaction.

Opium.—It is the inspissated juice of the *Papaver somniferum*, or white poppy, a plant which is a native of Asia, and from the fact of its growing wild in the southern parts of Europe, it is supposed to have been native there also. The probability, however, is that the seeds of it were conveyed to these regions from Asia. In Greece the poppy was cultivated at a very early period, long indeed before the time of Hippocrates. It is alluded to by Homer in the Iliad, and the *Roman* historian Livy gives a notice of it as cultivated in the gardens of Tarquin the Proud. It was not, however, for the purpose of obtaining what is now called opium that this plant was so much cultivated by the ancients, nor was it used at that early day as a medicine. Strange as it may appear to us, it was cultivated entirely as an article of food, and the part used was the seeds, which were considered as not merely destitute of all noxious and narcotic properties, but exceedingly nutritious. In such honor was the poppy held, that its discovery was attributed to the goddess Ceres, and from this circumstance she was named *Mecone* (from μήκων, papaver). It was offered to her in her sacred rites, and she was represented as holding it in her hand. It can hardly be supposed that so much importance would have been attached to the poppy, unless it had been looked upon as a very valuable article of food. That there is nothing noxious in the seed of this plant has been proved by modern observations. Dr. Allston states that he frequently ate large quantities of the black as well as the white seed—that he found them of a more delicious taste than sweet almonds—that they are oily and farinaceous, and he never found them to produce any injurious or soporific effects. Besides, they are still used as food in some places as well as the expressed oil, which is as innocent and wholesome as olive oil." In Persia, it is stated that even at the present day, where the plants spring up too thickly in the fields in which they are sown, the young ones are taken up and used as pot herbs. That the modern poppy plant is identically the same as that which was known among the ancients, is abundantly shown from the descriptions left by Dioscorides and Theophrastus.

When opium, as now used, was first known, is a matter of uncertainty. By some medical antiquarians it is traced as far back as the time of Homer, and it is contended that what he describes under the name of νεπενθες, was nothing more nor less than opium. Against the supposition, however, of this being opium, it is urged that neither Theophrastus nor Pliny, nor any of the ancients, who mention the nepenthes, took it for opium; and further, that the Egyptian, Arabian, Persian, and Indian names of opium are evidently

from the Greek word ὀπιον, as ofium, aufian, ofium, afiuum, &c. Dr. Allston thinks it most probable that the discovery of the soporific property of opium is due to the Greeks, and that it was first ascertained by Hippocrates, or at any rate about the period in which he lived. It does not appear, however, to have been prescribed with this view in medicine until two or three hundred years after this.

Although a native of Asia, the poppy is not confined to any particular country or latitude. It easily accommodates itself to different degrees of temperature, and is found flourishing in various parts of the world. In Hindostan, Persia, Asia Minor, and Egypt, it is extensively cultivated for the opium which it yields. In Europe it is cultivated principally for the poppy seeds and the oil. In different parts of the United States it has been reared with success, and good opium procured from it.

Although it thus appears that the poppy flourishes very well in different regions of the world, yet, like many other plants, it is considerably modified by situation, soil, and climate, and from the same causes the opium which it yields varies in its powers. "Egypt" is said to produce "a stronger opium than any of the countries on the north side of the Mediterranean, France than England or Germany, and Languedoc than the northern parts of France; while Smyrna, Natolia, Aleppo, and Apulia furnish a juice far more narcotic than Languedoc." (Paris, p. 58.) By some the opium raised in England is pronounced superior to the Turkey or East India opium. If it is so, it is probably owing to the greater care with which it is prepared. In the southern parts of the United States there is no doubt that opium might be obtained equal to any in the world, and it might be an object worthy of some of the enterprising capitalists of our country to make the attempt.

The poppy is an annual plant. In India, where it attains a much larger size than it does in any other part of the world, it flowers in the month of February. In Europe and America, in June and July.

The greatest height to which it attains in situations favorable to its growth, is from five to six feet. Every part of it contains a narcotic juice, but it abounds most in the *capsules*, and from them the opium is obtained.

The mode of procuring it, as practised in India, is the following: When the large capsules are about half ripe, longitudinal incisions are made on their sides, just deep enough to divide the external part without penetrating the internal cavities. This operation is performed in the evening. During the night the juice, which is of a white, milky appearance, oozes out, apparently from the vessels of the bark of the capsules, and adheres to the sides of the incision. In the morning this is scraped off, and deposited in an earthen pot, where it is worked by wooden spatulas in the sunshine, until it attains a certain degree of consistency. It is then formed by the hand into cakes. These are laid in earthen basins to be further dried, when they are covered over with poppy or tobacco leaves. It is

then ready for exportation, and this is the opium of medicine and commerce.

The quantity of this article produced in various parts of the world, and especially in Hindostan, is enormous. To give you some idea of it, I will merely state, that in one year (1832–3) upwards of 3,000,000 of pounds were smuggled into China from India, valued at upwards of fifteen millions of dollars.—See Pereira.

Physical Properties.—Opium comes in opaque masses of considerable size, of a compact texture. It possesses considerable tenacity, and is plastic under the fingers. Its color is reddish brown or deep fawn. Its odor is peculiar and narcotic; taste bitter and acrid. When exposed to the air it becomes hard, breaks with a shining fracture, and yields a powder of a yellowish brown color.

Varieties of Opium.—These are the *Turkey*, the *East India*, the *Egyptian*, and the *European.*

1. *Turkey Opium.*—Of this there are two different kinds, the *Smyrna* and the *Constantinople* opium. The first of these is what is commonly known under the name of Turkey opium. It is raised in Anatolia, and shipped from Smyrna. This is considered as the best kind of opium. It comes in irregularly-rounded or flat masses, covered with the capsules of a species of rumex. It is sometimes mixed with another kind, which is in balls or round masses, which are hard and of an inferior quality. Turkey opium contains a larger quantity of *morphine* than any other kind, the average being about eight per cent.

With regard to the *Constantinople* opium, Guibourt says there are two kinds—the one comes in large flattened masses like the Smyrna opium. This is of a good quality. The other comes in small flattened cakes, from two to two and a half inches in diameter, and always covered with the poppy leaf, the median nerve of which usually marks the middle of the mass. The odor of this kind is similar to the preceding, only feebler. When exposed to the air it dries and blackens.

By some it is supposed that the Constantinople opium is the same as the Smyrna, remanufactured and adulterated with gum at Constantinople. Guibourt, however, suggests that the difference may be owing to the original preparation of it, by expressing the poppy juice, and mixing this with the juice obtained from the simple incisions.

The Constantinople opium is more mucilaginous than the Smyrna—is never covered with the rumex, and contains only about one half the quantity of *morphine.*

2. *East India Opium.*—This is very inferior to the Turkey opium. It comes very seldom to the United States. It is chiefly sent to China, where an immense quantity of it is sold. There are different kinds of it. Some is in large balls, weighing three or four pounds, covered with a case half an inch thick, made of tobacco leaves and poppy petals agglutinated

together; within these the opium is of a pitch-like mass. This is commonly called *Bengal opium.* It has a strong empyreumatic smell, but not much of the peculiar narcotic, heavy odor of Turkey opium. Its taste is more bitter, equally nauseous, but less acrid. Its color is blacker, and its texture less plastic, but more friable. (Dom. Chemist.)

East India opium contains about half the quantity of morphine which Smyrna opium does.

3. *Egyptian Opium.*—This comes in round flattened masses, about three inches in diameter, of a regular shape, and appears to have been covered with some leaf, of which only the vestiges remain. It comes from Egypt, and is distinguished from the Smyrna opium by its red color, resembling that of the true hepatic aloes; by its odor being weaker and somewhat musty. By exposure to the air it does not blacken, and it softens instead of drying, in consequence of which its surface is shining, and it sticks to the fingers; and, finally, by its texture being uniform and not granulated, showing, according to Guibourt, that it was mixed before it was made into masses.

According to Guibourt, this contains less morphine than Smyrna opium, in the proportion of five to seven. It differs, however, very much in this respect.

4. *European Opium.*—In France, Germany, and England very good opium is obtained from the poppy. It can never, however, become an object of cultivation in these countries from the great cheapness of foreign opium. English opium resembles very much the Egyptian, and yields, in some cases, seven per cent. of morphine. From the French opium, Pelletier obtained as much as ten per cent.

Purity and Strength of Opium.—As brought into the market opium is generally very impure, being mixed with various articles, such as the extract produced by boiling the poppy, cow dung, ashes, and dried leaves of the plant, extract of liquorice, gum arabic, tragacanth, aloes, flour, oil, and various other articles. To increase the weight, bullets, stones, fruits, &c., are also mixed with it. (Dom. Chem.)

Besides this the strength of opium is modified by the quantity of water combined with it. Some is quite soft, some hard.

Again, the strength varies according to the locality where the poppy is grown. In this respect there is a great variety, as before stated.

To ascertain the real strength of opium, the only certain mode is to find out the quantity of morphine which it contains.

Mode of detecting Impurities.—1. By physical examination. In this way stones, &c., may be discovered. 2. Make a decoction of the suspected article and strain. In this way Pereira detected ten drachms of stones and gravel in ten ounces of opium. 3. If to a decoction of opium, when cold, tincture of iodine be added, and a blue precipitate (iodide of starch) be thrown down, it shows the presence of flour or starch.

The quantity of water in opium is to be judged of by the consistence and the loss on drying. Opium may be considered as of inferior quality when it is very *soft*, *greasy*, *light*, *friable*, of an *intensely black color*, mixed with *herbaceous substances* or exhibiting *dark brown* or *black patches of extract.* A weak or *empyreumatic* odor, a *slightly bitter*, *acrid*, or *sweetish* taste, and the power of *marking a brown* or *black* continuous streak, when drawn across paper, are also signs of poor opium. (Dom. Chem.)

To ascertain the quantity of morphine, Pereira recommends the following process: "Prepare an aqueous extract of the opium to be examined, and dissolve it in water; add ammonia to the boiling liquor, and when cool, filter; wash the precipitate on the filter with cold water, dry it, mix it with proof spirit, and add, drop by drop, acetic acid, until the solution slightly reddens litmus. By this means the morphine, and not the narcotine, is dissolved. Precipitate the morphine from the filtered solution by ammonia."—Vol. ii. p. 692.

Chemical Properties.—From the great importance of opium as an article of the Materia Medica, its chemical character has been investigated with the utmost diligence. It is only, however, to the chemists of the present century that we are indebted for any accurate knowledge in relation to it. In 1803 the first discovery of importance was made by Derosne, who detected in it the peculiar crystalline substance now known by the name of *narcotine*, but at first called the *salt of Derosne.* In 1804 Seguin discovered another crystalline substance in opium. Although he described the properties of it, he did not identify it as an alkali. About the same time this latter substance was also obtained by Sertuerner, of Eimbeck, in Hanover; but it was not until so late as the year 1817 that this chemist distinctly promulgated the fact that this substance was of an alkaline character, and that it existed in combination with a peculiar acid. The alkaline principle he supposed to contain the active part of the opium, and to this he gave the name of *morphine*, while the acid was called *meconic.* By the subsequent observations of Robiquet, not merely the character of morphine as an alkaline substance was confirmed, but it was ascertained that the salt of Derosne was an entirely different principle. By him the name of narcotine was given to it.

The foregoing account is interesting, not merely in itself, but as it led the way to all those discoveries which have since been made of the existence of alkaline substances in a great variety of vegetables.

According to the most recent analysis, opium may be considered as made up of the following constituents. It is one of the most complex articles in the Materia Medica. Of its constituents six are crystalline, azotized, and more or less alkaline.

1. *Narcotine* (from ναρχωτικος, narcotic).—Discovered in 1805—neutral and salifiable.

2. *Morphine* (from Morpheus, the god of sleep).—Discovered in 1804; established in 1817—alkaline and salifiable.

3. *Codeia* (from κωδεια, a poppy head).—Discovered in 1830 by Robiquet—alkaline and salifiable.

4. *Narceine* (ναρκη, stupor).—Discovered in 1832 by Pelletier—neutral, not salifiable.

5. *Thebia.*—So called from the city of *Thebes,* in Egypt; also called *Paramorphia,* from its being considered isomeric with morphine. Discovered in 1835 by Pelletier—alkaline and salifiable.

6. *Meconine* (from μηκων, a poppy).—Discovered in 1830 by Couerbe—crystalline, but contains no azote—neutral, not salifiable.

Meconic Acid.—An acid peculiar to opium. In addition to these it contains *gum, resin, fixed oil, volatile odorous principle, caoutchouc, extractive matter, lignin,* and various inorganic salts, such as sulphate of lime, sulphate of potassa, &c.

Opium is partially soluble in water, alcohol, ether, wine, acetic and citric acids. Its best menstruum is proof spirit.

Effects on the System.—Like all narcotics, this substance differs greatly in its effects according to the quantity in which it is taken. In *moderate doses,* its primary effect is to excite the system. The pulse is slightly increased in force and frequency, and a sense of fulness is experienced in the head. Along with this, the energy of the system is increased. The mind is exhilarated, the ideas flow more quickly, and a comfortable and pleasant sensation is experienced throughout the whole system. After continuing for a short time these effects pass off and are followed by a general diminution of the energy and sensibility of the system. External agents lose their influence on the body. Pain, if present, is relieved and a tranquil serenity pervades the system. Finally, all this is succeeded by drowsiness and sleep. The average period during which the exciting operation of opium continues is from half an hour to an hour, while the sedative effects continue for seven or eight hours. On awaking from sleep there is generally felt some nausea and headache, together with slight tremors—the appetite is impaired and the bowels are left more or less constipated.

When given in *doses somewhat larger,* all these effects are produced in a more marked degree. The primary excitement is much greater, but it passes off more rapidly and is sooner succeeded by the sedative effects, which are also much more marked. The general insensibility is greater—the pulse is slower than natural, and the sleep is more profound, approaching to a state of stupor. The constitutional disturbance left behind it is also greater.

In *poisonous doses,* the sedative effects of opium principally show themselves, without any of the stimulating effects. Giddiness and stupor speed-

ily come on. There is loss of sense and motion—the breathing is slow but easy—the features become ghastly—the pupil is contracted—the pulse is feeble, and death succeeds.

Such briefly detailed are the effects of opium on the system. For the purpose of understanding them more fully we shall analyse the various effects produced on the different organs and tissues of the body.

1. *On the Brain and the Nervous System.*—When opium is taken into the stomach it makes its primary impression on the nerves of that organ. The brain and the rest of the nervous system are next affected. That the nervous system is specially acted on is manifold from all the effects. To this are owing the primary excitement and subsequent insensibility which attend its operation. With regard to the brain, it is evident that a greater or less accumulation of blood takes place in the cerebral vessels. Where the dose has been large this is particularly striking and, where death results, is proved by dissection. As a general rule, in these cases, turgescence of the vessels and effusion into the ventricles are met with. (Christison and Beck.)

The prominent effects then on the nervous system are primary excitement and subsequent depression and insensibility. In large doses, cerebral congestion, profound sleep, coma, insensibility, paralysis, and contraction of the pupils.

2. *On the Vascular System.*—A great difference of opinion has existed in relation to the effects of opium on the circulation. According to the experiments of Crumpe, the pulse at first becomes accelerated, but afterwards reduced to the natural standard and even below it. In experiments made by Dr. Bard, on the contrary, the pulse from the beginning is stated to have been slower than natural. It is to be observed, however, that Dr. Bard does not give any account of the state of the pulse until half an hour had elapsed after taking the opium. During this period he probably would have found the pulse accelerated. The truth is, however, that the pulse varies under the influence of this drug. As a general rule it is moderately excited at first, but as the system gets under the influence, it becomes slower and fuller. In poisonous doses, the pulse appears to vary still more—being sometimes much increased in frequency, small and irregular—at other times fuller and slower than natural. (Christison.)

In the capillary vessels, the experiments of Alston show that under the influence of opium the circulation is rendered slower and a consequent congestion takes place. As the result of this, blood accumulates in the larger blood-vessels, and the vessels themselves become distended. Hence the increased fulness of the pulse and the sense of fulness about the head and chest which is experienced. (Edin. Med. Essays, vol. v. p. 129.)

3. *On the Mucous System.*—The effect here is to check secretion and exhalation, and this is owing to a peculiar action on the secretory vessels. This effect is observable in almost every portion of the mucous

membrane. In that lining the mouth and throat, by dryness and thirst. In the trachea and bronchial tubes, by the diminished expectoration which takes place in morbid states of the membrane lining these parts. In the membrane lining the stomach and bowels, by the loss of appetite and by the discharges from the bowels being less copious and less liquid.

4. *On the Glandular System.*—The general effect of opium on the glands is to lessen their secretion. Thus the *liver*, under its influence, secretes less bile. This is proved by the evacuations from the bowels. If one or two doses of opium be taken immediately after the bowels have been evacuated, the next discharge will be of the peculiar whitish or ash color which indicates the absence of bile. On the *pancreas*, we infer that a similar effect is produced, although we have not the same evidence of the fact. That the secretion from the *salivary glands* is impaired by opium, is evident from the dryness of the mouth and from the effect in checking excessive salivation. On the *kidneys* the same effect is produced—the secretion of urine being generally lessened. I have known it absolutely arrested for eighteen hours by an opium suppository.

5. *On the Cutaneous System.*—Here the effect of opium is peculiar. Instead of restraining the secretion from the skin, as it does the others, it creates a determination to the surface and promotes perspiration. In some cases, it causes a sense of pricking and itching, terminating occasionally in an eruption.

6. *On the Respiratory System.*—Here the effect is to render respiration slower. Where poisonous doses have been taken, the breathing frequently becomes stertorous.

7. *On the Intestines.*—The general effect of opium is to produce constipation. This it does in various ways: first, by diminishing the secretion of bile; second, by lessening the secretion from the mucous membrane of the intestines; third, by impairing the muscular contractility of the canal; fourth, by rendering the intestines more or less insensible to the natural stimulus of their contents.

8. *On the Muscular System.*—During the primary operation of opium the muscular power may be increased, but the final effect is to impair its energy and cause relaxation. This is seen in various parts of the muscular system. The muscular power of the stomach and intestines is lessened. The power of the bladder is also impaired. This latter is proved by the fact that under the influence of opium the bladder frequently becomes distended with urine, while none of it is evacuated—showing an abundance in the secretion, but an inability on the part of the bladder to evacuate it.

Circumstances modifying the effects of Opium.—The two circumstances by which the effects of opium are modified were alluded to when speaking of narcotics generally, viz. age, and the habit of using them. All that was then said of the class of narcotics is specially applicable to this drug. It is not necessary to go into any recapitulation here, but the great importance of

the subject will justify a repetition of the caution then given as to the exhibition of opiates to young children. Too much caution cannot be taken in giving any, even the simplest and safest or rather *least dangerous* of the preparations of opium to children. You can never calculate beforehand how they will be affected by them. Do not suppose that I denounce opium in the diseases of children; it is most valuable—often indispensable, if only it is given *wisely*.

VARIOUS MODES IN WHICH OPIUM MAY BE APPLIED TO THE SYSTEM.

These are four—introducing it into the stomach, applying it to the skin, introducing it into the rectum, and injecting it into the veins.

(1.) *Introducing it into the Stomach.*—This is the ordinary mode of using it, and as a general rule the most efficacious.

(2.) *Introducing it into the Rectum.*—This is the next most common mode, and a very convenient and efficacious one where from the nature of the case it cannot be swallowed, or where from the irritability of the patient's stomach it is rejected. In this way solid opium may be introduced in the shape of a *suppository*, as it is called; or the tincture of opium added to a small quantity of fluid may be injected. In using it in this latter way it is important to recollect that the size of the injection should be as small as possible—otherwise from mere mechanical distension the rectum will be excited and expel the injection. In this way the effect of the article will of course be lost. By some it is supposed that opium introduced into the rectum operates more powerfully on the system than when taken into the stomach. Orfila in particular has attempted to establish this. So has Dupuytren. A question of this kind, however, can easily be settled by ordinary observation, and this has established the fact that its action is by no means so energetic. As a general rule, at least double the quantity is required to produce the same effect on the system.

(3.) *Applied to the Skin.*—Applied to the unbroken skin the effect of opium is limited in a great measure to its topical operation, and in this way it is frequently very efficient in allaying irritation and pain. If, however, the cuticle be removed, or if it be applied to the surface of wounds or ulcers, it produces all its constitutional effects. Sir Astley Cooper states that he has known a solution of opium applied upon an extensive scald in a child to destroy life. The manner in which we get the effects of opium at present by external application is by the use of some of the salts of morphine by the endermic method. The cuticle is first separated by means of a small blister, and then about a quarter of a grain of the acetate or sulphate of morphine is to be applied to the abraded surface. It may be applied either in the form of powder, solution, or cerate. The best place for applying it is the back of the neck. According to Lem-

bert, the inventor of the endermic method, it operates more powerfully here than when applied to any other part. Applied in this way it produces all the usual effects of the article, the same as when taken by the mouth—and it has been used in this way very successfully in the management of a number of complaints of a painful character.

(4.) *Injecting into the Veins.*—This has been attempted in one case by Coindet of Geneva. The case was a girl of fourteen years of age affected with tetanus. Opium internally having failed to produce any effect, he dissolved a scruple of opium in warm distilled water (the quantity is not mentioned) and then filtered. A residuum of 12 grs. was left on the paper, but "the narcotic principles were almost all in the solution." An opening was made in the basilic vein of the right arm, and with a fine syringe a drachm was injected every five minutes until five injections were made. No alarming symptoms occurred, and the patient recovered. The vein was slightly inflamed, but this was gradually and easily relieved by leeches and cold applications. "The patient described the effect of the injections as if a torrent of liquid fire had been poured through the veins of the arm, concentrating in her chest, and thence dispersed over the whole body, attended with violent heat and pricking of the skin. These sensations, she said, were of a most painful nature."* The foregoing experiment shows that opium may be injected into the veins without fatal results. Still the practice is a dangerous one, and ought not to be resorted to except in such cases as hydrophobia, tetanus, and the like.

CONDITIONS OF SYSTEM FAVORABLE AND UNFAVORABLE TO ITS USE.

From the decided effects of opium it is evident that it cannot be used in all conditions of the system with impunity, much less with advantage. While in some it proves not merely a safe but salutary agent, in others its use is attended with the greatest danger. It becomes, then, important to know, if possible, the conditions under which it may or may not be used.

1. In the first place, *a plethoric condition of the system is unfavorable to its use.* The reason of this is obvious from what has been said in relation to its general effects. Given in certain quantities we know that it produces congestion of the brain, and in some cases apoplexy. When the habit is plethoric this of course is much more likely to occur, and may do so even from moderate doses. In this condition of the system, therefore, it ought to be abstained from.

2. In the second place, *wherever there exists determination to the brain it ought not to be used.* In this state of things the necessary effect of opium is to increase the difficulty.

* Johnson's Medico-Chirurgical Review, vol. iv. p. 936.

3. In the third place, *wherever general inflammatory excitement is present it ought to be used with great caution.*—In this condition of the system it acts as an additional stimulant, causing frequently unpleasant determination to the brain, shutting up all the secretions, and thus augmenting the general excitement. I do not mean by this to say that opium should not be used in inflammatory complaints; it may be, and sometimes with great advantage, but there must always be some preliminary or accompanying treatment to modify the inflammatory action to enable us to use opium safely.

4. In the fourth place, *whenever the skin is hot and dry accompanied by a dry tongue*, opium is improper. It this state it generally adds to the excitement.

5. In the fifth place, *a costive state of the bowels* generally renders the use of opium objectionable.

With regard to the condition of the system favorable to its use, it is that in which the blood-vessels have been properly evacuated, their action suitably reduced, the surface free, the tongue moist, and no determination to the brain present. When these conditions obtain, it may safely be given, should the case require it.

OF THE APPLICATION OF OPIUM IN THE TREATMENT OF DISEASES.

As a remedial agent, opium has always and justly been looked upon as one of the most valuable in our possession. It has been styled the *donum Dei*, the gift of God to man, and Sydenham says of it, that it is "so necessary an instrument in the hands of a skilful physician, that the art of physic would be defective and imperfect without it; and whoever is thoroughly acquainted with its virtues and the manner of using it, will perform greater things than might reasonably be expected from the use of a simple medicine."* High as this panegyric is, it is unquestionably just. Admirable, however, as this agent is, if properly used, it is equally true that in unskilful hands there is scarcely any capable of producing a greater amount of mischief. That this must be the case is evident from the effects which it produces, and particularly from the difference in these effects, according to the dose in which it is given, and the precise condition of the system at the time. Too much care, therefore, cannot be exercised in studying its effects, or in discriminating the condition of the system in which it may be safely and advantageously used.

For the purpose of illustrating its effects, I will now notice briefly some of the diseases in which it is most frequently resorted to.

* P. 115.

FEVERS.—In this class of diseases it is used continually, but for various purposes, according to the character of the fever and the condition of the system. In the *intermittent* form of fever, it is mainly used for one purpose, and this is to arrest or modify the paroxysm; according to the manner in which it is given, it may either prevent entirely the return of the paroxysm, or mitigate its violence as well as its duration. To prevent the paroxysm altogether, it should be given in a suitable dose about an hour before the time of its expected return, and as a general rule it has the desired effect. This was the practice originally suggested by the illustrious Sydenham, and since his time has been in general use. As it is impossible to say exactly when the paroxysm will return, the best plan is to give it as soon as the patient begins to feel any of the symptoms which usher in the chill—such as languor, stretching, creeping of the skin, &c.; as it is desirable to have it operate as speedily as possible, the liquid preparations should be preferred, and a full dose be given. From thirty to sixty drops of laudanum, or an equivalent quantity of the other preparations administered in this way, often prevents the return of the paroxysm, or if it does not, renders it milder and shorter. With regard to the manner in which opium operates in this case, all we can say is this:—Intermittent fever depends for its continuance upon a certain condition of the nervous system; now, opium by the powerful impression which it makes upon this system, modifies its condition, and in this way the chain of morbid action is broken in upon, and the paroxysm is prevented.

As a general rule, you will not find it necessary to have recourse to opium in this way in the management of intermittent fever; the action of quinine is prompt enough to answer every purpose. Occasionally, however, you will find it a valuable resource, especially when danger is apprehended either from the violence of the paroxysms, or from the debility of the patient.

By some opium has been given in the *cold stage.* This was the practice of Dr. Trotter. By Dr. Lind it was given in the *hot stage*, about half an hour after it had commenced, and with uniform success in shortening the paroxysm and mitigating all the febrile symptoms. When used in this way, he states it to be followed by refreshing sleep and a more free perspiration, causing in this way a more perfect intermission. On this account, he says, less bark is necessary to effect a final cure. The practice of Lind has been tried by others, and with similar success.

Now, contrary as this practice seems to all our preconceived notions in relation to the operation of opium, it may still, I think, be satisfactorily explained. It is to be recollected that the hot stage of intermittent differs materially from the excitement of inflammation or continued fever. It is nothing more than a spasmodic, convulsive reaction of the vascular system, consequent upon the depressing impression of the cold stage. It is of tem-

porary and limited duration, always coming to a natural crisis. In some respects it is analogous to the convulsive reaction which takes place after the depressing effects of the loss of large quantities of blood. Now, we know that in the convulsive condition of the vascular system arising from the loss of blood, opiates are among our best remedies. They quiet irritation, equalize the circulation, and calm the convulsion raging in the system. In a similar way, probably, do they operate in the hot stage of intermittent. Although this practice, therefore, is safe, generally speaking, yet it ought not to be resorted to where the habit is very plethoric, or where local inflammation may be present.

In the *continued forms* of fever opium is an article which should be used with caution, and in its use every regard should be had to the period of the disease and the actual condition of the system. Early in the disease when great excitement is present, characterized by a strong and frequent pulse, hot skin, flushed face, headache, &c., it is manifestly improper, and would inevitably aggravate the symptoms. On the other hand, in the later periods of the disease, where general debility has come on, and where morbid irritability is present, unattended by inflammation, it may be used with great advantage. Under these circumstances there are two objects for which opium has been given. In *the first place*, it has been used by some as a general stimulant to support the sinking powers of the system, and for this purpose it has been prescribed in small and repeated doses. In *the second place*, it is used simply with the view of relieving particular symptoms—such as sleeplessness, morbid irritation of the brain, diarrhœa, subsultus tendinum, &c. In this way it is only given in occasional doses, according to the special circumstances of the case.

In the practice of the present day, the first of these modes of using opium is, I believe, generally abandoned. As general stimulants indicated in fever we have in wine and other articles, agents greatly preferable to opium. It should be recollected that opium, although primarily a stimulant, is ultimately sedative, and its continued use in the collapse attending the advanced stages of fever must eventually prove injurious by still further depressing the powers of life. Besides this, opium checks all the secretions with the exception of that from the skin, and in this way frequently proves injurious. As a general stimulant, therefore, in these cases its use appears to me improper.

The other mode of using opium in fever is for the relief of particular symptoms depending upon morbid irritation, and it is only in this way it is now used by judicious practitioners. Among the symptoms or conditions for which it may be used, the following are the principal: 1. *The want of sleep.* This is a constant and distressing occurrence in fever, one which adds greatly to the protraction of the disease and the exhaustion of the patient. To obtain sleep is a matter of great importance, and it may be produced by opium, if properly given. For this purpose all

those circumstances should be attended to which I have already mentioned as favorable to the action of this agent. Where there is great cerebral excitement, or inflammation of that organ is present; where the blood-vessels are too full, the skin hot and dry, and the secretions generally locked up, opium will usually fail in the object intended. All these circumstances, therefore, should be carefully attended to and corrected.

2. Sometimes it is used to relieve *delirium*. In using it for this purpose, however, it is to be recollected that delirium may depend upon different and opposite states of the system. Thus it may depend upon inflammation of the brain, or upon irritation of that organ—the result of general and local debility. In the two cases you will find opium act differently. In the first, it does no good, and frequently aggravates. In the second, it may be of service. Even in this latter case, however, it must be used with caution. Large doses of opium operate as sedatives, and thus add to the exhaustion of the patient. In most cases tonics and stimulants will generally answer better than opium. Occasionally the additional use of opium may prove of service.

3. It may be used for the purpose of checking diarrhœa.

Now, in all these cases it must be used with special reference to the condition of the system. In the congestive forms of fever you cannot be too cautious about the use of this agent, as it is frequently fraught with the greatest danger. This is especially the case where anything like congestion of the brain is present.

Inflammation.—The use of opium in inflammation is a subject of great interest, and one, I fear, concerning which you will find nothing very satisfactory in the books. It is prescribed in a great many cases, and with advantage, and yet the *principles* upon which it is used do not seem to me very clearly understood. In consequence of this, you will find the use of it frequently vague and empirical. Now the first remark that I would make is, that opium does not exercise any control at all over inflammatory action. It quiets pain and produces insensibility. But this is all that it can do, and this only temporarily. Besides, after the effect of the opium passes off, the inflammation, so far from being relieved, is generally made worse, and the reason is obvious from the very effects of opium. Instead of evacuating the inflamed vessels, opium checks the secretions, and in this way still further engorges them. As a remedy, then, per se in inflammation, it is not merely useless, but injurious. In this way, therefore, it is never to be used. As an adjuvant, however, to other remedies, it may be made exceedingly useful, and should never be neglected. Now, the objects for which we use it as an adjuvant, are: 1. To allay the reaction which generally succeeds the loss of blood in inflammation. 2. To allay pain and irritation consequent upon inflammation. To accomplish these objects there are two general modes in which we use it. By combining venesection and the use

of calomel and tartar emetic with opium. Now the rationale of this combination is the following, and is perfectly philosophical. The venesection reduces the inflammatory action, and brings the system into a condition in which opium produces simply its sedative and soothing operation, and in this way it acts most kindly on the disease. Then, again, the calomel and tartar emetic co-operate most powerfully with the venesection in subduing inflammatory action, keeping down the pulse, and promoting all the secretions. By these various means the system is kept in a state in which the opium may be safely used, and in this way you get from it the only effect which you wish to obtain, i. e. its soothing effects, while you rob it of all its exciting and disturbing qualities.

Another mode of using opium in inflammation is so to subdue the inflammatory excitement, as that nothing need be apprehended from the stimulant or astringent operation of the opium, but that only the sedative effects shall follow. This is done by bleeding at first to deliquium, and then giving a large dose of opium. If the symptoms return the same may be repeated, and to remove the remaining traces of inflammation, calomel and ipecac. with the opium in smaller doses, may be resorted to. This is the practice recommended by Dr. Armstrong. (Lect. 394.) Now, the principle upon which he used opium is simply this. If you merely bleed a patient laboring under inflammation, however copiously, without following it up by any other remedy, you will find that in a short time he recovers from the effects of it, reaction takes place, and the inflammatory excitement is renewed, although perhaps in a milder degree. To subdue this further depletion will be found necessary. If, on the contrary, after free depletion you give a large dose of opium, it quiets the irritability of the system, vascular and nervous, upon which the renewal of the inflammation depends, and in this way the subsequent excitement is rendered so moderate as to be manageable by the other remedies just mentioned. This is a kind of treatment which you will find very useful in cases where it is important to husband the strength of your patient as it regards the loss of blood. Most patients, however delicate, will bear one good bleeding, while repeated bleedings may exhaust them.

Now, if you reflect upon these two modes of using opium, you must see, I think, that opium has no direct agency in controlling the inflammation at all. This is done by the venesection, tartar emetic, ipecacuanha, and calomel; and the only effect of the opium is to soothe and prevent reaction. In both these respects, however, it is invaluable, and if used with discretion and judgment, may aid wonderfully in conducting the case to a favorable issue.

This, then, is the principle upon which I think opium ought to be used in inflammation—not to arrest inflammation itself, but to control some of the effects of it. If this be correct, it must be obvious that it ought never to be used in the early stages of inflammatory complaints. In conse-

quence of not attending to this, it is to be feared that many a case of inflammation has terminated fatally; commencing insidiously—perhaps mistaken for spasm—opium has been given, the patient has apparently been relieved, until in a short time inflammation has developed itself in such a way as to be uncontrollable. In all cases, therefore, where you are in doubt about a case being inflammation or spasm, be cautious in the use of opium. It cloaks up the disease in such a way that you may not be able to distinguish it before it is too late.

Although the principle upon which we use opium is perhaps the same in all cases of inflammation, yet it is greatly modified in its application by various circumstances, and they must be specially attended to. The principal of these is the locality of the inflammation, not merely as regards the tissue which is the seat of it, but the particular part of the tissue.

Inflammation of Mucous Membranes.—In some of these you will find opium a useful remedy, while in others it is highly objectionable. When inflammation assails the mucous membrane of the *air passages*, &c., as a general rule, opium ought not to be used. In *laryngitis*, *croup*, *acute bronchitis*, it is a remedy fraught with danger. The natural solution of these inflammations is by bringing about secretion from the affected surface. Now, opium prevents this, and in this way increases general excitement, pulmonary engorgement succeeds, and the patient sinks, as it were, strangulated to death. When the mucous membrane of the *stomach* and *bowels* is the seat of inflammation, opium may be used with more freedom, and generally with great benefit. Thus, for example, in some cases of *poisoning*, the gastric irritation is so great as to require the use of this remedy, and it acts with great effect. In *dysentery*, too, it is a remedy of great value. It allays the excessive irritation of the intestines which is present in this disease, relieves the perpetual desire to go to stool, and at the same time restrains the acrid secretions from the inner surface of the intestines. It is to be recollected that opium here, however, does not operate by arresting inflammation, but by merely correcting some of the consequences of it. It is not, therefore, to be depended upon alone. It is to be combined with such remedies as have the power of controlling inflammation, such as bleeding and calomel. In this way you will find it not merely a valuable, but essential remedy. Among the best forms in which it can be given is that of Dover's powder. In combination with calomel, it is an admirable agent in the management of this disease. The calomel alters the action of the mucous membrane—changes the character of its secretions—while the Dover's powder allays the irregular action of the bowels, quiets pain, and at the same time equalizes the circulation by determining to the skin.

In inflammation of the mucous membrane of the urinary organs opium may also be used, but only after suitable depletion and evacuation. In

the early stages of *nephritis* and *cystitis*, accordingly, it should be abstained from. In *urethritis*, on the other hand, it may be used with much freedom.

In *inflammation of serous membranes*, opium is a remedy of great value as an adjuvant, and may be used with great freedom after copious venesection; especially is this true of peritonitis, in which opium may be given with greater freedom than perhaps in any other inflammation.

In *inflammation of solid viscera*, such as *pneumonia*, *hepatitis*, &c., opium may be used in the same way—not per se, but merely as an adjuvant.

In inflammation of *fibrous membranes*, such as rheumatism and gout, opium is a remedy of special value, as it fulfils in these cases the great indication of soothing and allaying pain. Before using it here, however, the system must be properly prepared. If necessary, bleeding, cathartics, and sudorifics, must be resorted to; when the system is properly evacuated and prepared, then you will find that opium, in the form of Dover's powder, alone or in combination with calomel, acts admirably in allaying the disturbance of the system.

Hemorrhages.—Although opium possesses astringent properties, and is continually used in checking profuse secretion, it does not seem to exert any direct control over bleeding vessels. As a remedy, therefore, to arrest hemorrhage, it is not to be used; it sometimes does a good deal of harm. When, however, large quantities of blood have been lost certain effects of a very serious character generally result, and it is for the relief of these that we have recourse to opium, and frequently with the best effects.

The first of these is the convulsive reaction of the vascular system, which usually takes place after considerable quantities of blood have been lost. In this condition of things there is a morbid irritability of the vascular and nervous systems, in consequence of which the actions of both become irregular and troublesome. The heart beats violently, the head throbs, &c. Now, to calm all this, there is no remedy so valuable as opium, and it manifestly operates by its soothing and sedative influence on the nerves, secondarily affecting the vascular system.

The second of these is actual convulsion and spasm, resulting from the loss of blood. This not unfrequently takes place, either from accidental hemorrhage or from venesection. When it does occur, opium is one of the best remedies to correct it.

You perceive, then, that opium is used in these cases, not to arrest the hemorrhage, but to correct certain effects resulting from hemorrhage. If you keep this distinction constantly in view, it will be a guide of some importance to you in the use of a remedy which I fear is very empirically used by many in these cases. Opium may, however, be still further useful in these cases, and this is by preventing the recurrence of hemorrhage.

When great vascular reaction takes place from the loss of blood, there is constant danger of a renewal of the hemorrhage, and the best mode of obviating this is by calming the circulation and quieting the irritability of the nervous system, and in this way opium aids wonderfully in conjunction with other remedies of a directly astringent nature, in preventing a recurrence of the difficnlty.

Diseases of the Brain and Nervous System.—From the peculiar effects of opium on the brain, it is evident it is an agent which must be used with great caution in affections of this organ, and there is none in which its use is frequently attended with more serious consequences. As a general rule, in all affections of the brain attended with *inflammation* or *congestion* opium is an improper remedy. Accordingly, in cases of phrenitis, apoplexy, &c., it is not to be used. Even in these cases, however, after suitable depletion, and during convalescence, it may be used occasionally with great advantage to allay irritability, quiet restlessness, and promote sleep.

In *paralysis* its use has been universally reprobated, and as a general rule, unquestionably it ought to be resorted to with caution. Even here, however, it may be used under suitable conditions of the system. Where the paralysis is not associated with a plethoric or congested state, it is frequently very useful to quiet irritability and produce sleep. On this subject the opinion of Heberden is valuable. "When I knew no more of physic," says he, "than what I had learned from books, I was very apprehensive, as I was taught to be, and by plausible reasoning, that opium was hurtful in palsies and apoplexies; for it is supposed to have the effect of deadening the powers of the nerves, and, therefore, must be improper where we want to enliven them. This hypothesis, however specious, wants the attestation of experience. I have met with some, who, while they were recovering from a palsy, used opium plentifully, and afterwards never passed a night without taking twenty or thirty drops of tinct. opii for many years, which practice did not hinder them from living very well, and was supposed to assist them in doing so. In consequence of these examples I have frequently given it in paralytic cases, when the restlessness seemed to require it, and with as much advantage as in any other disease." (Commentaries, p. 290.)

In Mania.—Opium has been highly commended by some and denounced by others. Whether it proves serviceable or not depends entirely upon circumstances. If it be used while there is great fulness of habit, or where there is active determination to the brain, and where the bowels are costive, it will be sure to aggravate all the symptoms. As a general rule, therefore, in the early stage of the disease, it will surely prove injurious. In the more advanced periods, where the system has been properly evacuated and reduced, it sometimes proves exceedingly salutary in quieting irrita-

bility and causing sleep. The dose to produce these effects ought to be large, otherwise more harm than good results from its use. Burrows recommends a large dose at first, to be followed by smaller ones until the desired effect is produced. Where an anodyne is admissible, he begins with three grains of opium, and repeats a grain every two or three hours. He has never in this way exceeded twelve grains, and if sleep do not follow from this he has desisted.* By others much larger quantities have been given.† It is only, however, after all, as occasional remedies that opiates are of service. Their continued use does no good, and in fact does injury by the constipation and other unpleasant effects which they occasion. Dr. Ferriar says, he has given opium to a great extent without any benefit in maniacal cases. In one case he gave as much as sixteen grains of solid opium in one day.‡ Cox says he tried opium to an almost incredible extent without perceiving any, even temporary, much less permanent advantage from it.§

It is an interesting fact connected with the operation of opium, that the insane are comparatively insensible to its effects, as they are to many other remedial agents. After the operation of an emetic, it has been found that smaller doses will affect the system.—(See Crumpe on Opium, p. 288. Cox on Insanity.)

There are two forms of maniacal disorder in which opium is a remedy of great value. The *mania of puerperal women* and the *mania resulting from the too free use of liquor.*

In *puerperal mania*, opium operates more kindly and beneficially than it does in the ordinary forms of mania, and the reason no doubt is the peculiar condition of the system under which it occurs being more favorable for obtaining the soothing and sedative effects of this drug. The patient is debilitated by the various evacuations attending delivery. The mania is frequently dependent merely upon nervous irritation and debility, and in this condition of the system opiates may be given with great prospect of success. Even here, however, they should not be given indiscriminately. If there should be fulness of the head, as indicated by heat of the head, flushed face, etc., opium should not be given until this is relieved by local bleeding, purgatives, cold to the head, etc. After these are removed, it may then be given in a full dose. Dr. Gooch recommends twenty minims of the sedative solution of Battley, repeated once or twice at intervals of two hours unless sleep be induced. When sleep has once been procured, small doses, such as five or ten minims, should be given at intervals of six hours. If these do not produce sleep at night the larger doses may be occasionally resorted to. Constipation should be obviated all this time by suitable cathartics. When opiates have produced

* Commentaries, p. 613. † Ibid. p. 612. ‡ P. 97. § On Insanity, p. 144.

the desired effect in this complaint, they should be withdrawn gradually, diminishing the dose and lengthening the interval.*

In *delirium tremens*. In this disease most enormous doses of opium have been given, and as a general result, if profound and long continued sleep follows their use, the patient will recover. But here the same cautions as to the exact condition of the system at the time when the drug is administered, that have been so often insisted on, are to be regarded. If plethora and determination to the brain exist, if the bowels are loaded, the tongue foul, the skin dry and hot, opium will do no good; and in delirium tremens, it may be laid down as an almost universal rule that where opium does no good it is certain to do harm. In multitudes of these cases life has been sacrificed in the vain, irrational attempt to overwhelm the system by opium. When the skin is cool and moist, the bowels free, the pulse soft, and the prostration not extreme, opium will often produce sleep and cure the disease. Where prostration is extreme, a large dose of opium may overwhelm the system and induce fatal consequences.

Preparations from the Poppy.—These may be divided into: first, those from the poppy head; second, those from opium; third, those from morphine.

Of the former there are but two.

1st. The syrup of poppies; a preparation which, though much used in England, is scarcely prescribed here. It is uncertain.

2d. The decoction of poppy heads which, is a good fomentation. Poppy heads scalded are sometimes added to bran, hops, and the like when used as a poultice, to make it more decidedly anodyne.

Preparations of opium.

1st. Pill. The U. S. Pharmacopœia direct ʒi to be made into 60 pills, each of course containing a grain. This is a common and excellent way of giving opium. The bulk is small, and the pill, especially if it has been made some time, rarely offends the stomach.

2d. *Pulvis Cretæ Comp. cum. Opio.*—One part of opium is combined with 36 parts of chalk. This facilitates exactness in giving small doses. It is little used in the United States.

Pulvis Opii et Ipecacuanhæ Compositus.—This is commonly known by the name of *Dover's powder*, and is prepared by taking *one part* of opium and ipecac, each, and of sulphate of potassa *eight parts*, and triturating to a fine powder. Ten grains of this contain one grain of opium. This is an excellent preparation, and furnishes a striking illustration of the advantages of combining medicines. The ipecac renders the opium more certain in its action as a sudorific, and at the same time corrects to a great extent the evil effects which opium alone is apt to produce on the head. The sulphate is added for the purpose of triturating more freely and mix-

* Gooch's Essays, p. 152; also Burrows, p. 400.

ing the ingredients more intimately. By some it is supposed that the general efficacy of the compound is thus increased, inasmuch as the opium and ipecac alone will not act precisely in the same way as when the potassa is combined. (Paris, p. 453.)

The Dover's powder may be used in all cases where a sudorific anodyne is required. The average dose for an adult is 10 grs.

Liquid Preparations. 1. *Tincture.*—Tinctura opii, Tinctura thebaica, commonly called *laudanum*, or *liquid laudanum.* This is prepared according to the U. S. P., by macerating for fourteen days ℥ iiss of opium in powder in two pints of diluted alcohol, and then straining.

This tincture is of a deep brownish red color, having the peculiar smell and taste of opium. In this preparation about two thirds of the opium are dissolved by the alcohol (water dissolves less than three sevenths)—Phillips. The residuum consists of impurities, containing still, however, a small proportion of morphine. Pereira says he has repeatedly prepared morphine from the insoluble residue thus left. Twenty-five drops (or thirteen minims) are about equivalent to one grain of opium.

The tincture of opium has some important advantages over the solid opium. It is more speedy in its action. When this is desirable it should be preferred. It can be given more conveniently in minute doses. This is a great advantage when an opiate is required for children. Lastly, it can be combined more readily with other medicines.

Incompatibles.—Care should be taken not to give laudanum in combination with ammonia, soda, and potash, or their carbonates, as they precipitate the morphine. Most metallic salts and tincture of galls also decompose it.

In the use of this article it is important to know that if it be kept for any length of time, and occasionally exposed to the air, it becomes thick. This is owing to the evaporation of a portion of the alcohol, and the deposition of the opium. In this state its strength is greatly increased, and infants have frequently been destroyed by giving this even in moderate and ordinary doses.* In all cases the tincture should be transparent.

2. *Tinctura Opii Camphorata.*—This is the common *paregoric elixir.* This consists of *opium*, *Benzoic acid*, *oil of anise*, *liquorice*, *clarified honey*, *camphor*, and *diluted alcohol.*

Half an ounce of this contains about one grain of opium.

This is a mild and valuable preparation of opium, and unites the properties of a narcotic with those of an antispasmodic. The principal use of it is to allay troublesome cough, unconnected with any inflammatory symptoms. It diminishes the sensibility of the bronchial membrane to the influence of cold air, checks profuse secretion, and allays spasmodic

* Ellis's Formulary. U. S. Disp.

cough.—Pereira, vol ii. p. 251. Besides this it is used to relieve nausea and slight pains in the stomach and bowels, and in infants to procure sleep.—U. S. Disp., p. 1034.

The dose for an adult is from ʒi to ʒiv; for a child, from five to twenty drops, according to the age.

3. *Acetated Tincture of Opium.* This is prepared by rubbing up ℥ij of opium with ℥xii of vinegar, and then adding half a pint of alcohol, and macerating for fourteen days and filtering.

In this preparation, it is supposed that a portion at least of the meconate of morphine is decomposed, and acetate of morphine is formed. Pereira, however, says this is not fully established.—Vol. ii. p. 715.

This is a very mild and valuable preparation of opium. It has all the narcotic effects of opium, without producing the nausea, headache, and nervous disorders, which frequently result from the ordinary preparations of this article.

Ten minims or twenty drops are equivalent to gr. i of opium. This preparation has been introduced into the U. S. Pharmacopœia, as a substitute for the ordinary *black drop*, and has the great advantage over that of uniformity and certainty in its strength.

4. *Vinum Opii.*—This is prepared by taking of opium ℥ij, cinnamon and cloves bruised each ʒi, and macerating in a pint of Teneriffe wine for fourteen days and filtering. This is nearly the same as the *liquid laudanum* of Sydenham. It is about the same strength as common laudanum, and may be given in the same doses. From the aromatics with which it is combined, it sits better on the stomach. As a local application, the wine of opium is recommended in cases of chronic ophthalmia, two or three drops being introduced under the eyelids daily.

Morphine.—*Modes of obtaining it.*—There are various modes of obtaining morphine from opium. It may be obtained in an impure state by simply adding ammonia to a strong solution of opium. In this way it is very copiously precipitated. In this case the water holds in solution the meconate of morphine, which is decomposed by the ammonia. Meconate of ammonia is formed and the morphine precipitated.

The process recommended in the U. S. Pharmacopœia is the following: Sliced opium is first macerated and worked up with water for a suitable length of time, then filtered, and to this added a mixture of alcohol and water of ammonia, when the morphia is deposited in a crystalline form. To purify these, they are boiled in alcohol, and filtered through animal charcoal. In this process the water extracts the meconate of morphine. This is decomposed by the ammonia, while the alcohol seems to suspend the coloring matter and render the crystals purer. Another mode is the following: Triturate powdered opium into a thin paste with acetic acid, and

afterwards add six or eight parts of water. To this add excess of ammonia and collect the precipitate on a filter.

This is *impure morphine.* This is to be purified by digestion in cold alcohol, which will remove the chief part of the coloring matter, and the residue being dissolved in *boiling alcohol*, furnishes crystals of *pure morphine* as the liquid cools.

The rationale of this process is the following: Morphine exists in opium in the form of a *salt*, *meconate of morphine.* The acetic acid decomposes this, and leaves a solution of *acetate of morphine*, which is again decomposed by the ammonia, and the morphine separated. The alcohol afterwards removes the impurities.

Morphine, as obtained by the preceding processes, contains more or less of narcotine. This may be separated by the action of sulphuric ether, which dissolves the narcotine, but does not act on the morphine, or by adding dilute muriatic acid, which unites with the morphine, but does not act on the narcotine. This is then to be decomposed by water of ammonia.

In all the foregoing processes, the principles are few and simple. The morphine is first extracted from the opium, either in the form of *meconate*, or combined with some *acid* added to the menstruum. It is then precipitated by ammonia, and afterwards purified by alcohol, or by the action of ether or dilute acid.—See U. S. Disp. p. 927.

Quantity of Morphine in Opium.—This has already been alluded to. As then stated, it varies not merely in the different kinds of opium, but in different samples of the same kind. The Smyrna opium contains the most, varying from nine per cent. or less to fourteen (U. S. Disp. p. 931), the *Constantinople* only one half, and the *Egyptian* five sevenths of the quantity obtained from the Smyrna opium. Dr. Christison obtained from half a pound of the best Turkey opium 3½ drachms of morphine, and two drachms of narcotine. M. Dublanc procured as the mean of six trials eight per cent. of morphine and three per cent. of narcotine.—(Poisons, p. 518.)

Properties.—When pure, morphine is in small, beautiful white crystals. The primary form of the crystal is a right rhombic prism. It has a bitter taste, but is destitute of smell. In *cold water* it is insoluble—*boiling water* dissolves about one part in one hundred. It is soluble in forty parts of cold anhydrous alcohol, and thirty parts when boiling. In *ether*, it is nearly insoluble. It turns vegetable blues to green, and combines with the acids forming crystallizable salts—nitric acid turns it red.

It consists of oxygen, hydrogen, carbon, and nitrogen.

Effects.—Although the most powerful principle in opinm, morphine is not used in medicine in its simple alkaline state. Owing to its great insolubility, it is by no means certain and constant in its effects, depending for its activity, no doubt, upon the degree and kinds of acid it meets with in the stomach. In combination with acids it is, however, very soluble, and it is only in the

form of salts, therefore, that it is used. Of these, the ones used are the *acetate*, *sulphate*, and *hydrochlorate*.

Acetate of Morphine.—This is prepared by dissolving Morphine in dilute acetic acid, and then evaporating the solution to dryness. Acetate of morphine crystallizes in slender needles, but from its deliquescent nature is seldom obtained in a crystalline form. It is generally in the form of a powder. It is readily dissolved in water, especially where there is an excess of acid. In alcohol it is less soluble than in water.

It may be given in *pill* or *solution*. One sixth of a grain is about equivalent to a grain of opium.

Sulphate of Morphine.—This is prepared by dissolving morphine in diluted sulphuric acid. By evaporating the solution crystals are formed. These are small, white, and feathery, resembling very much in appearance the sulphate of quinine. They can easily be distinguished, however, by adding concentrated nitric acid. This turns the sulphate of morphine red, which does not take place with the sulphate of quinine. Sulphate of morphine is soluble in twice its weight of boiling water, and if pure, is easily and readily soluble in cold water.

As found in the shops, and especially if obtained from France, it is not always entirely soluble in water. This is owing sometimes to adulterations, but oftener to its containing some uncombined morphine, owing to the mode of preparation.—See U. S. Disp. p. 934. This is corrected by the addition of a little acid.

The sulphate may be given in pill and solution. One sixth of a grain is equal to a grain of opium.

Solution of Sulphate of Morphine.—It is important to know that there are two solutions of this salt of very different strength—that of Magendie, and that of the United States Pharmacopœia.

Magendie's contains sixteen grains to ℥j of water. Of this, five drops are equivalent to one sixth of a grain of the salt.

U. S. Pharmacopœia contains one grain to ℥j of water—of this, eighty drops are equal to one sixth of a grain.

Hydrochlorate of Morphine.—This is prepared by saturating the pure base with hydrochloric acid, and crystallizing. In the London Pharmacopœia, another mode is recommended.—See Phillips.

This is a colorless, inodorous, bitter salt, crystallizing in plumose acicular crystals; it is soluble in sixteen to twenty times its weight of water. It is also soluble in alcohol.

The strength of this is the same as the two preceding. This is considered by many as the best salt of morphine for medical purposes. To the *acetate* it is preferable, as it is more easily obtained in crystals, and is not subject to decomposition during its preparation.

Effects of the Salts of Morphine.—In their action on the system they do not differ. They produce the same effects, and may be given in the same doses. Compared with opium and its ordinary preparations, they differ in many important particulars. While they produce the *anodyne* and *narcotic effects* of opium, they are less *stimulating*—they are *less sudorific*—they do not have the same tendency to produce *constipation*, and they are less apt to leave headache, nausea, dryness of the tongue, and other unpleasant effects behind them. In all cases, therefore, where the object is to allay pain and nervous irritation, and to produce sleep, they are preferable to opium. Where the object is to get an astringent effect on the mucous membrane, or a stimulant effect on the system, opium is to be preferred. In cases of chronic irritation, where the daily repetition of an anodyne is called for, the morphic salts are invaluable. Another advantage attending them is, that they may be applied endermically.

Narcotine.—Discovered in 1803 by Derosne, and hence originally called the *Salt of Derosne.* By Serturier it was supposed to be the *meconate of morphine.* Robiquet subsequently proved it to be a separate principle, and the name of *narcotine* was given to it.

Mode of obtaining it.—Digest the watery extract of opium in *sulphuric ether.* This holds the narcotine in solution, but does not act on the meconate of morphine. By filtration and slow evaporation, impure crystals of narcotine are deposited. By subsequent processes, it is purified.

Properties.—When pure, it exists in white needle-like crystals, without taste or smell. In cold water, insoluble; in hot, slightly so. In fixed oil, ether, and alcohol, soluble. It produces no effect on vegetable colors. It unites with most of the acids, forming with some crystallizable salts. These salts are more bitter even than the salts of morphine.

Effects.—As yet the knowledge in relation to the effects of this article is not very satisfactory. By Magendie it was given to dogs, and he found that one grain of it dissolved in oil produced profound stupor, and that death in twenty-four hours was the ordinary result. Combined with acetic acid, however, the effect was different, and the animal could bear twenty-four grains without being destroyed. The same physiologist at one time supposed that narcotine was the *stimulating principle* of the opium, as morphine is the sedative principle. For the purpose of testing this, he made the following experiment: A solution of one grain of morphine and one grain of narcotine, both dissolved in acetic acid, were put under the pleura of a dog. For more than half an hour a constant struggle appeared to be kept up between the stimulating effects of the narcotine and the sedative effects of the morphine. Finally, the animal fell sound asleep, and as Magendie thinks, under the sole influence of the morphine.*

* Formulaire par Magendie, p. 69, 8th ed.

It is hardly necessary to say that this experiment is altogether inconclusive, and does not warrant the inference drawn from it. It was, however, repeated by Dr. Bardsley, of Manchester, on a rabbit, and with different results. He says "he could perceive no remarkable struggle between the stimulating effects of the narcotine and the anodyne effects of the morphine.* The animal slept soundly in an hour."

That narcotine is the stimulating principle in opium has been deduced entirely from the experiments of Magendie on animals. To test this, Dr. Bardsley gave it to several patients, and he states, "without finding that it produced any marked excitation."† According to the observations of Dr. Tully, too, narcotine is wholly destitute of all stimulant properties, whether given in full doses or in divided doses at intervals. As the result of a series of experiments, he states that in no case was there any increase of vital energy, of arterial action, or of animal heat; nor was there any sensation of fulness or throbbing in the head. On the contrary, the pulse was invariably reduced in frequency, "in two cases as much as twenty-six beats in a minute, and in none less than eighteen in the same time. Generally the force and fulness of the pulse, too, were abated. These effects, he adds, were the same, whether the narcotine was given in substance or dissolved in dilute acetic acid or olive oil.‡ According to Dr. Tully, narcotine operates more kindly on the nervous system than either opium or morphine. He thinks it more decidedly soporific than either, and the sleep produced by it peculiarly calm and placid.

In excessive doses it produces a confused state of the head, vertigo, nausea, and vomiting. All these symptoms, however, are less unpleasant than similar ones produced by opium or sulph. of morphine. On the *skin* it proves diaphoretic like opium, and frequently causes itching of the whole surface. The other secretions appear to be affected very much as they are by opium. It causes dryness of the mouth and throat, checks the renal secretion, and constipates the bowels. According to Dr. Tully, a *full* medical dose is from two to five grains; a medium dose is one grain, which may be repeated at intervals of three hours. He found no difference in effect, whether given alone, in acetic acid, or oil.

From the foregoing observations of Dr. Tully, therefore, it would appear that no advantage is to be gained by separating the narcotine from opium.

More recently, by Dr. O'Shaunessy, narcotine has been asserted to possess tonic and antiperiodic properties, resembling those of quinine; and by him

* Hospital Reports, &c. p. 81.

† Hospital Reports, p. 81.

‡ Results of Exps. and Obser. on Narcotine and the Sulphate of Morphine. By W. Tully. Silliman's J. vol. xxi. p. 48.

a large number of cases of intermittent fever have been successfully treated with it.—Brit. and For. Rev. viii. 263.

As a narcotic, narcotine is not used in medicine, and notwithstanding the conflicting statements of authors, Pereira is disposed to consider it as nearly inert.

Codeia.—This is said by Magendie to be analogous to morphine in its operation, and one grain is considered as equivalent to half a grain of morphine. It is never used in practice.

Henbane.—The *Hyoscyamus Niger*, growing two or three feet high, with large sea-green leaves, and straw-colored flowers. The whole plant has a dark, lurid appearance. It is found in every part of Europe, and extends to Asia. In this country it is supposed to have been naturalized, from the fact of its being found only in the vicinity of houses, road sides, in old fields, gardens, &c. It is only met with in the Northern and Eastern States, from Nova Scotia to Rhode Island, and extending back to New York and Canada. In Ohio and Pennsylvania it is very rare, and at the South quite unknown. (*Rafinesque's Flora.*)

Every part of this plant is possessed of activity. The only part, however, that is used officinally in this country is the *leaves*. When fresh, these have a mucilaginous and slightly acrid taste, and when bruised emit a strong, fœtid, and narcotic odor. Thrown on the fire they burn with a noise as if they contained nitre, and give out a strong smell. By drying the leaves lose both their taste and smell. Diluted alcohol extracts all their virtues.

The active principle of the henbane is *Hyoscyamine*, a vegetable alkali, obtained by Brande from the seeds and the herb—resembles in its properties very much *atropine*. Besides this an *empyreumatic oil* has been obtained from it by destructive distillation. Its chemical properties identical with those of the empyreumatic oil of digitalis, and is a powerful narcotic poison.

Effects.—In some respects henbane resembles opium in its action on the system. In moderate doses, it first slightly quickens the pulse; after this, diminishes sensibility, calms the system, and eventually produces sleep. In larger doses, general insensibility speedily comes on, there is profound sleep, dilatation of the pupil, and in some cases delirium accompanied with a full pulse, indicating great cerebral congestion.

Opium and henbane resemble each other in the power of diminishing sensibility and calming the system, inducing sleep and acting on the skin. In some important respects, however, they differ. 1. In its primary operation and in small doses henbane is not so stimulating as opium. 2. It does not constipate the bowels like opium — it rather relaxes

them. 3. Opium lessens the urinary secretion, while henbane increases it. 4. On the organ of vision the effect of the two differs—opium contracts, henbane dilates the pupil. The same effect is produced by the local application of henbane to the conjunctiva. As a remedial agent henbane has many advantages over opium, and may be used as a substitute for that article where it does not agree with the patient. It calms the system, allays pain, and produces sleep, at the same time it does not shut up the secretions. It may be given in all irritable states of the nervous system with advantage. It is commonly, too, combined with cathartics to obviate their irritating effects without lessening their cathartic power.

Mode of Administration.—Two extracts, a watery and an alcoholic, are officinal as is the tincture. Dose of the extracts grs. i to ij. Of the tincture ʒi to ʒij.

[One grain of extract hyoscyamus combined with one of camphor makes the best anodyne pill for the use of females subsequent to confinement with which I am acquainted. I direct a pill at bedtime, and another every hour till sleep is obtained. Rarely are more than three required.—Ed.]

Lactucarium.—This is a peculiar substance obtained from the *Lactuca sativa*, or garden lettuce, a plant extensively cultivated both in this country and in Europe. The leaves and stem of the plant abound in a juice which has a milky appearance, but on exposure to the atmosphere it concretes, and becomes of a brownish color, resembling opium. This is the *lactucarium*, by the French called *theridace.*

Preparation.—The mode originally suggested by Mr. Young, of Edinburgh, for obtaining it is the following. The top of the stem is cut off when the plant is in flower about a foot above the ground, and the juice which exudes from the cut surface is absorbed by means of a moist sponge, from which it is again squeezed into a proper vessel and inspissated. As soon as the cut surface ceases to yield the juice, another slice is to be taken off, and this is to be continued as long as juice continues to be poured out. On standing it concretes and changes to a brown color.

Properties.—In its taste and smell lactucarium bears a strong resemblance to opium. It is soluble both in water and in alcohol. At one time it was supposed to contain morphine. Caventou, Dublanc, and Ganzel, in their analysis of it, could discover no trace of this principle.

Physiological Effects.—In its action on the animal economy lactucarium resembles opium, impairing the sensibility of the system and inducing sleep. It is more mild, however, in its operation, and does not leave behind it any of the unpleasant effects which so frequently follow the use of opium, such as stupor, headache, and nausea. Unlike opium it does not constipate the bowels, and according to the experiments of Dr. Francois, it acts on the circulation as a direct sedative. In a number of cases

in which he gave it the pulse was reduced from seven to twelve beats in the minute.*

Mode of Administration.—Given in pill, dose grs. x to ℈ i. Tincture, ʒi to ʒiij. It is very little used.

HUMULUS LUPULUS.—This is the common hop, a plant growing native both in Europe and America. In both also it is extensively cultivated. In different parts of the United States it is found growing spontaneously. The part of the plant used are the strobiles. These are picked when the plant is scarcely ripe, and gradually and carefully dried. Five pounds of fresh hops make about one pound dried.

Properties.—The strobiles of the hop consist of thin scales of a greenish yellow color; they have a strong, fragrant, and somewhat narcotic odor and a bitter, aromatic taste. The surface of these scales is covered with a yellow powdery substance, which is easily separated by sifting the hops through a common sieve. It is supposed to be peculiar to the female plant, and to be secreted by the nectaria. To this powder the name of *Lupulin* has been given. It is in the Lupulin that the active principles of the hop chiefly reside.

The strobiles yield their virtues to boiling water, alcohol, and ether. By long boiling, they lose their aromatic flavor.

Physiological effects.—As a narcotic the powers of the hop are feeble, and it is not to be compared with opium and other articles of this class. Nevertheless, it is capable of lessening sensibility, assuaging pain, and inducing sleep. In other respects it differs from opium. It is tonic to the digestive organs and proves laxative to the bowels. It is probably in consequence of this that it is not so apt to produce headache as opium. In its general properties, therefore, it resembles more nearly the hyoscyamus, and may frequently be used with great advantage as a substitute for the more potent narcotics.

Mode of Administration. 1. *Substance.*—In the form of powder, twenty grains may be given to an adult. In the experiments made by Bryaily, this caused nausea and catharsis without affecting the pulse.

2. *Infusion.*—Half an ounce of the hops, added to a pint of boiling water. Of this two or three ounces may be taken three or four times a day.

3. *Tincture.*—This is the most common form of using it. The dose is from ʒi to ʒij.

LUPULIN.—This, as already stated, is a peculiar substance obtained from the hop. It is in the form of small, shiny, yellowish grains, having an aromatic smell and bitter taste.

Chemical Properties.—According to the analysis of Chevalier and Payen, lupulin contains resin, volatile oil, and a peculiar bitter principle. It is to

* Magendie, p. 349.

this bitter principle that it has been proposed to restrict the name of *lupulin.* Lupulin is soluble in water, alcohol, and ether, and to all these substances imparts its bitterness.

Physiological Effects.—In its general operation, lupulin resembles the hop itself, acting as a tonic and narcotic.

Mode of Administration. 1. *Substance.*—In doses of from six to twelve grains made up into pills.

2. *Tincture.*—This is made by digesting ℥ ij of lupulin in a pint of alcohol. Of this the dose is from one to two drachms.

3. *Hop Pillow.*—This is frequently resorted to as a soporific, and has undoubtedly some force in controlling restlessness. It was rendered *fashionable* in England towards the close of the last century, from the circumstance that it was prescribed by Willis with great apparent benefit to George III.

Conium Maculatum.—This is the hemlock, and was formerly known by the name of *cicuta.* It is a large umbelliferous plant, indigenous in Europe, but now naturalized and growing in great abundance in this country. It has a striated stalk from three to five feet high, with purple spots upon it. These characters of the stem distinguish it from other plants resembling it. (Christison, p. 620.) In this country it is found in old fields, near roads and fences, and flowers from June to August. The whole plant has a disagreeable smell, generally compared to the urine of the cat. The part used in medicine is the leaves.

Properties.—The leaves are of a beautiful green color. When dried they lose somewhat of their disagreeable smell, though they still retain a strong narcotic odor and have a slightly bitter and nauseous taste. The fresh leaves are supposed to contain both a narcotic and an acrid principle. By drying, the latter is dissipated, while the former undergoes no change. This process, therefore, improves their medicinal virtues. When pulverized, which is readily done, the powder, to be good, should retain the beautiful green color of the leaves, and with this the peculiar odor of the plant. It is important to recollect that exposure to light dissipates the color, and with it the virtues of the article. It should, therefore, always be kept in a dark situation.

Chemical Composition and Properties.—According to the analysis of Brande, conium contains resin, albumen, coloring matter, an odorant volatile oil, salts, and a peculiar alkaline principle, to which the name of *coneine* has been given. By others it is called *cicutine.* The most appropriate, however, is *conine.*

Effects.—These differ with the dose. In very small doses it may be continued for a long time without producing any effect either upon the digestive organs or upon the constitution at large. When a full dose is given so as to affect the system, the following effects show themselves:

giddiness, a sense of fulness in the eyes, feeling as if they were pushed from their sockets, slight sickness at the stomach, dryness of the throat and fauces, together with a trembling agitation of the whole body and impaired muscular power. Along with these there are generally one or two loose evacuations. If given in doses a little short of those in which it produces the preceding effects, its most obvious and striking operation on the system is that of lessening sensibility, allaying pain, and promoting rest. On the circulation, conium produces no marked effect. It differs from opium in not constipating the bowels, nor does it create thirst or leave headache behind it like opium.

Modifying Circumstances.—In the whole range of the materia medica, there is perhaps no article which differs so much in its ordinary effects as the conium, so much so indeed as to have given rise to the most contradictory accounts in relation to its use in various diseases. Abundant evidence of this fact will be found by consulting the observations of those who have treated of this article. In a practical point of view it is important to appreciate the causes of this discrepancy, and they are mainly two —a difference in the strength and purity of the article, and a difference in the mode of using it.

1. *Of the Strength and Purity of the Article.*—As found in the shops, the preparations of conium vary greatly. This fact was noticed so long ago as the time of Dr. Cullen. He states that he frequently found the extract which was imported from Vienna a perfectly inert substance. The same thing has also been observed by Dr. Jackson of Boston, in relation to that which is imported into this country from England.

2. *Difference in the mode of using it.*—This is another circumstance which may aid us in accounting for the discrepancy of testimony in relation to the effects of this agent. Some physicians, fearful of the effects produced by this powerful article, have given it in doses too small or introduced it so slowly, that the system never properly felt the effects of it. While others, commencing with too large doses, abandoned the medicine at once, in consequence of the violent effects which may have been occasioned. There is no doubt that in both these ways the reputation of the conium has greatly suffered. It becomes, then, a matter of importance to know how far it should be carried so as to secure its beneficial effects to the fullest extent. As a general rule it may be laid down that no good is to be derived from it unless it produces some sensible effect on the nervous system, as manifested in the head and stomach by giddiness and nausea. As the conium differs so much in its strength, the safest plan is to begin with a small dose, say gr. j, to be increased every day until these effects are produced. As soon as this takes place, it should be discontinued until they subside, and then as large doses should be persisted in as can be borne without reproducing them.

Mode of Administration. 1. *Powder.*—Of this the average dose is about

three or four grains. This is the most certain form in which it can be used if freshly powdered but it soon becomes inert.

2. *Extract.*—This is prepared by inspissating by a gentle heat the juice of the fresh leaves to a proper consistence. According to M. Brande, 100 ℔s. weight of the leaves yield from three to five pounds of the extract. To be good this should have a clear olive color, a fœtid odor, and a bitterish saline taste. The average dose is about five grains.

3. *Tincture.*—This is a good form of using it. The dose is from half a drachm to a drachm.

Diseases in which the Conium has been used.—In the whole range of the Materia Medica, there is perhaps no article which has given rise to such contradictory statements in relation to its uses and effects in various diseases as the conium. While by some it has been lauded as an agent of great power, others have denounced it as wholly useless. The causes of this discrepancy must in a great measure be obvious, after what has already been stated in relation to the variable strength of the article, and difference in the mode of using it. Notwithstanding what may have been said to the contrary, if the article be really good, and if it be used to a sufficient extent to produce its specific effects, there can be no question that in many cases it is a valuable remedy. Although known to the ancients,* and used as an external application, it does not appear to have been used as a medicine internally, until about the middle of the last century.

1. *Cancer, Scrofulous and Malignant Ulcers.*—These were the diseases in which the conium was first used by Storck, and its virtues particularly lauded. As might readily be supposed from the character of these diseases, subsequent experience by no means confirmed the high character given to this article by him; although it has established the fact of its affording a certain degree of benefit even in these intractable diseases. In genuine cancer, although said to have been cured by Storck with it, abundant evidence has shown that nothing is to be expected from it. Alibert reports that of upwards of 100 cases of cancer of the uterus and other parts, which were treated with this remedy at the hospital of St. Louis, not one was cured.† Although, therefore, it is incompetent to a cure of genuine cancer, yet it is not without benefit that it has been used even here. Dr. Rutty states, that although he never knew of a single case of cancer cured by it, yet in a great number of cases it retarded the progress of the disease, "lessened the tumors, alleviated the pain, mended the dis-

* By the Greeks it was used as a poison; and it is this which is supposed to have been the article given to those eminent men of antiquity, Phocion and Socrates, when they were condemned to an ignominious death by their unjust countrymen.

† Eberle, vol. ii. p. 64. See also Fothergill in Med. Obs. and Inqr. vol. iii. p. 400, and Rutty, ibid. vol. iii. p. 234.

charge, changing it from a thin, ichorous, and fœtid condition to one more like a laudable pus, and disposing the parts to heal."*

In scrofulous tumors and ulcers it has been of still greater advantage; and numerous cases are reported in which, under its use, they have been cured.† In painful tumors and ulcers of an ill-conditioned character, but not specific, it has also been used with great advantage.

Upon the whole, the result of experience in relation to the conium in the preceding affections seems to be, that although possessed of no power to cure those of specific character, yet even in these it operates advantageously, by relieving pain and allaying general and local irritability. By accomplishing these important objects, it renders the patient more comfortable, improves the character of the discharge, and retards the progress of the disease. While in those which are not of a specific character, it places the system in a condition the most favorable to an effectual cure.

2. *Syphilis.*—In certain forms of this disease conium has been used with benefit. By Hunter it is recommended; and in certain conditions of indolent buboes he speaks of it as one of the best remedies.‡ Cullen, too, speaks of it as in many cases of syphilis proving a valuable adjuvant. In syphilitic chancres of an irritable character, "conium given in very small doses will often do much good."

3. *Neuralgia.*—In this disease the conium was, I believe, first recommended by Dr. Fothergill;§ and by him several cases are recorded in which it was attended with success—curing the disease. In the hands of others since his time it has by no means sustained its reputation.

4. *Pulmonary Consumption.*—In this disease, the conium may be used with much advantage. By Dr. Paris especially it is lauded in the highest terms. Like every other remedy it is, however, only palliative. That it tranquillizes pulmonary irritation in a remarkable manner is certain; but that it can effect a cure, as Dr. Paris intimates, is expecting too much from it. He gives it in doses of five grains of the extract three times a day, to be continued till the specific effects of the article are produced.‖ He recommends the following prescription:

℞. Ext. conii
Ext. hyoscyam. āā ℈ij.
Mucilago acaciæ ʒij.
Tere et adde

* Med. Obs. and Inq. vol. iii. p. 234.

† Boyle, vol. iii. p. 620. See Eberle's Practice. Med. Obs. and Inq. vol. iii. p. 284.

‡ On the Venereal, p. 260. Bell, vol. ii. p. 234. Cullen vol. ii. p. 189.

§ Obs. and Inq. vol. v.

‖ On Diet, pp. 199, 200.

Liquoris ammoniæ acetatis ℥i.
Aq. puræ ℥ivss.
Vin. ipecac. ʒi.
Syrupi Rhæad. ʒij.
Ft mistura, de qua sumantur coch max. ter in die.

In the New York Hospital I have used the inhalation of the saturated tincture of conium with iodine, according to Scudamore's prescription, with great benefit. It certainly relieved the cough and lessened the expectoration, and altogether made the patients more comfortable.

5. *Chronic Rheumatism.*—Here it is also a remedy of value. Dr. Thomson says he has seen it produce more beneficial effects in chronic sciatica than any other medicine.* In a case of this kind in the New York Hospital, the disease which has resisted a great variety of remedies yielded readily to the conium, in grain doses repeated every two hours. It is also used and with great benefit in syphilitic rheumatism.

Atropa Belladonna.—This is the *deadly nightshade*, a perennial plant indigenous in Great Britain. It grows in woods and shady places, and is also frequently cultivated in gardens. It has a thick root with three or four stalks branching from it, and growing to the height of from three to five feet. Its flowers are of a reddish color and bell-shaped. It bears beautiful berries of a large size and purple color. The whole plant is poisonous, and the berries have frequently proved fatal to those who, from their beauty, have been tempted to eat them. The part generally used in medicine is the *leaves*.

Properties.—When fresh, the leaves have a faint narcotic smell, which they lose by drying without having their active properties at all impaired. Their taste is not striking; subacrid and slightly nauseous.

Chemical Properties.—According to the analysis of Mr. Brande, the belladonna contains an active principle of an alkaline character. This is *atropine*, and exists in combination with malic acid. Besides this it contains a green resin, wax, starch, gum, lignin, albumen, and various salts. Both water and alcohol dissolve the active principles of belladonna.

Atropine.—This substance is in needle-like crystals of a brilliant white color, without taste or smell; almost insoluble in water and in cold alcohol, but very soluble in boiling alcohol. In ether and oil of turpentine also insoluble. It unites with the acids, forming crystallizable salts, and seems to possess a greater neutralizing power than any of the vegetable alkalies.

Effects.—These differ with the dose. In very small doses, no sensible effect is produced, with the exception perhaps, in some cases, of a dilatation of the pupils. In these doses the action of this agent is probably confined

* Mat. Med. vol. i. p. 575.

in a great measure to the local impression which it makes upon the part with which it comes in contact, impairing the sensibility and susceptibility of that part. In larger doses, such as it is generally given in medicine, the most marked effects which are produced after its use has been continued a certain time are a sense of fulness about the head, dilatation of the pupil, more or less dimness of the vision, with a sense of dryness and constriction of the throat, accompanied frequently with a difficulty of swallowing. On discontinuing the use of the article these effects speedily disappear. On the vascular system no marked effect is produced. On the secretions and excretions it produces little effect, although by some it is supposed to increase the secretion of urine. Of all the effects produced by belladonna, the most curious is that of invariably *dilating the pupil.* In whatever way it is applied to the system this effect will follow, whether taken internally, applying the extract around the eye, or to a wound. When taken internally, so as to affect the pupil, the sight also is much obscured. Applied externally, it generally dilates the pupil without affecting the sight. This, however, is not invariably the case.* The dilatation comes on about an hour after the application, and passes off in the course of two or three days, if the use of the article be discontinued. In *poisonous doses* it produces dryness of the throat, vertigo, dilatation of the pupil with obscured vision, and a peculiar delirium resembling intoxication. This is accompanied generally with excessive and ungovernable laughter, sometimes with constant talking, and occasionally with a total loss of voice. After continuing some hours this is succeeded by stupor, slight agitations of the muscles, without regular convulsions, and finally death. (See Christison.)

From the foregoing it would appear that belladonna makes a peculiar impression upon the nervous system, lessening sensibility and irritability. This is more especially manifested in the throat and the eye, upon both of which it produces transient paralytic effects. It is accordingly used in medicine with the view of allaying pain and spasm, and obtaining its peculiar effects upon the organ of vision.

Modes of Administration. Powder—made from the dried leaves is the most uniform in its strength, and is therefore preferable on this account to the other preparations. The dose to begin with is about one grain, to be given once or twice a day, and increased gradually until the specific effects of the article begin to show themselves. To children one eighth of a grain is sufficient as a dose.

* Mr. Tyrrell relates two cases of temporary amaurosis produced by the extract applied to the surface of irritable ulcers of a malignant character. In one case the disease was situated in the vagina, and in the other in the rectum. The pupils of the eyes were extremely dilated, as from the application of the extract to the organ itself, and the patients were incapable of distinguishing any objects for some honrs. In the case of ulcerated vagina, the application was repeated, when it produced exactly similar effects.—A. Cooper's Lectures, vol. i. p. 79.

Extract.—This is prepared by bruising the fresh leaves in a mortar, then sprinkling a little water over them, expressing the juice, then evaporating to a proper consistence. Of this the dose is one half a grain repeated two or three times a day. To a child one twelfth is sufficient. Like the extract of hemlock, this is apt to vary in its strength.

Diseases in which the Belladonna is used.—*Various affections of the eye.*—It is in these that the very curious effect which belladonna produces on the eye is most usefully applied. As already stated, when applied to the eye, it dilates the pupil and produces a partial paralysis.

In Cases of Cataract this is resorted to with great advantage. By the great dilatation of the pupil which it occasions, it enables us in the first place to ascertain the nature and extent of the disease, whether the iris be adherent to the capsule of the crystalline lens or not, whether the cataract be complete or only partial. Then, in the operation, it gives great advantage in fixing the iris and destroying the irritability of the organ.

In inflammation of the Iris, where adhesions are constantly threatened, this application, by dilating the pupil, prevents, and sometimes breaks up partial adhesions.* Finally, in *irritability* of the eye it answers admirably in allaying irritation; it is also used in opacity of the cornea.† The mode of applying it in these cases is to drop a little of the infusion into the eye, or a little of the extract dissolved in water may be applied to the lids.‡

2. Upon the same principle it has been applied, locally, with success to continued *rigidity and spasm* in other parts of the system. By Chaussier it was used in cases of rigidity of the neck of the womb, interfering with delivery. For this purpose he employed an ointment made by rubbing two drachms of the extract with an ounce of lard. Of this, a bit the size of a filbert was applied to the neck of the womb, and generally succeeded in relaxing the os uteri.§ By Dr. Conquest the same practice was resorted to with great success. In applying the belladonna in cases of this kind it is to be used, however, with caution, as the paralysis may extend to the uterus itself. A case of this kind is related by Blackett, in which both the neck and mouth were dilated and the womb paralysed.

* See Mackenzie, specially, p. 358. † See Bayle, v. ii. p. 512. Dict. Mat. Med.

‡ Mackenzie directs that, the evening previous to the operation, extract of belladonna, moistened to the consistence of cream, is to be smeared on the eyebrow and eyelids, and allowed to remain till about half an hour before the operation, when it is to be washed off with a sponge and tepid water. If the pupil is not by this time fully dilated, a little filtered solution of extract of belladonna in water is to be dropped on the conjunctiva, not rudely dashed, with a hair pencil.—p. 502.

§ See Eberle, v. ii. p. 78. Dict. Mat. Med. v. i. p. 492.

Six hours intervened before the contractions of this organ returned.* By Chaussier it was applied also in uterine convulsions. With the same view it has been successfully applied, externally, in cases of *spasmodic strictures* of the urethra and of the *rectum*, in *chordee*,† *hæmorrhoids*, and in *strangulated hernia*. Four cases of this latter kind are stated to have been completely relieved in this way.‡

3. *Hooping Cough.*—In this disease the belladonna has been extensively resorted to and with considerable advantage. On the continent of Europe its reputation stands exceedingly high, and by many it is looked upon in the light of a specific. For such an opinion as this of course there can be no foundation. Notwithstanding this, in many cases, if properly used, it is a remedy of great value. As a general rule it should never be prescribed until after the system has been properly prepared by previous evacuations, such as, in some cases, venesections, emetics, and cathartics. This is especially necessary where the habit is plethoric, and where there is much determination to the head. Whenever, too, any bronchial inflammation or general fever are present, it should never be used until these are subdued. Under these restrictions it frequently proves exceedingly beneficial in mitigating the paroxysms of cough and shortening the duration of the disease. Dr. Eberle states that he used it in twenty cases, and in the majority with great advantage.§ He recommends it to be given by dissolving four grains of the extract in an ounce of sweetened water, and of this giving from eight to twelve drops three times daily to a child under two years old.‖ By Dr. Thomson one eighth of a grain was given to a child eight years of age, and gradually increased to one fourth of a grain. During its use, he says, "it produces a state of the skin closely resembling Scarlatina, accompanied with fever, suffused eye, dimness of sight, and frequently, although not always, headache. While these symptoms continue the cough is absent, but it returns as soon as they disappear. By keeping the habit for a sufficient time under the influence of the remedy, the period of the disease has always been greatly shortened."¶ From the uncertainty of the extract the root has been recommended as preferable. In the form of powder this may be given in doses of from one eighth to one fourth of a grain, three times daily, according to the age.** By some frictions to the epigastrium with it have been found beneficial.†† By Hufeland the proper period for commencing the use of this remedy is said to be about the fifteenth or twentieth day of the disease.

4. *Neuralgia.*—In this rebellious form of disease belladonna has been used, and in many cases with great success. Among those who recom-

* Bayle, v. ii. p. 513.
† Dict. Mat. Med. v. ii. p. 492.
‡ Ibid. Bayle, 513.
§ On Children, 483, also Mat. Med. v. i. 75.
‖ Mat. Med. ii. 75.
¶ Mat. Med. v. i. p. 567–8.
** Ibid. 567. Eberle, v. ii. p. 75. Dict. Mat. Med. v. i. p. 44.
†† Dict. M. M. Ibid.

mend it most highly is Dr. John Bailey of England. The cases recorded by him were all neuralgic affections of the head and face, and it is when seated in these parts that he considers the belladonna peculiarly efficacious. The preparations used by him were the extract and the tincture.*

[*Dysmenorrhœa.*—Belladonna has been used with success in this disease, both taken internally, applied to the surface of the back as a plaster (empl. belladonnæ), and introduced into the vagina as a suppository.

Combined with ipecac (half a grain of each), it has in my hands exercised more control over this affection than any other one thing.—Ed.]

Datura Stramonium.—This is commonly known by the names of the *Thorn apple, Jamestown weed, Stinkweed, &c.* It is an annual plant, growing to the height of three or four feet. It is found in every part of the United States, Canada, Mexico, South America, also in Europe, Africa, and Asia. With regard to the native country of this plant there has been considerable difference of opinion. The common belief seems to be in favor of its being a native of this continent, and that it travelled through the East Indies and Persia to Europe. In the earliest English writers on plants it is called the thorn apple of Peru, and the Spaniards assert that the first seeds of it were received from Peru, under the name of *cachos*, and that it had previously been held in high repute as a medicinal plant both by the natives and Spaniards in Peru. Into England it was introduced in the reign of Queen Elizabeth from Constantinople. That the stramonium is not a native of the United States there is every reason to believe. It is always discovered along the roads and near habitations, never in the woods and mountains. Mr. Rafinesque says the Indians call it "the white people's plant," and he adds that its migrations can be traced from New England and Virginia, and that in the Western States it has sprung up only since their settlement, and from seeds carried there. This plant blossoms from May to September in the Southern States, and from July to October in the Northern.

Properties.—The whole of this plant possesses active properties, and has a fœtid, narcotic smell, which of itself sometimes causes headache and stupor. The parts chiefly used in medicine are the *leaves* and *seeds*.

The *leaves* are large, from five to six inches in length, of a deep green color on the upper surface and pale green underneath. When fresh and bruised they have a fœtid, narcotic odor, which they lose on drying. Their taste is bitterish and nauseous, and when chewed they give the saliva a green tinge.

The *seeds* are small and of a dark color, having the peculiar taste of the leaves, but destitute of smell.

Chemical Properties.—By Brande the *seeds* were ascertained to con-

* Dict. Mat. Med. vol i. p. 492.

tain a peculiar alkaline principle, which he called *daturine*, gum, a butyraceous matter, orange-colored extractive, together with various salts. (Dict. Mat. Med. vol. ii. p. 598.)

The active properties of the stramonium are yielded both to alcohol and water. *Daturine* exists in the seeds of the stramonium in combination with malic acid. In its pure state it is in the form of acicular prisms, almost insoluble in water and in cold alcohol. In boiling alcohol it is very soluble, and with the acids it forms crystallizable salts.

Effects.—In its action on the system stramonium resembles very nearly the belladonna. In moderate doses, sufficient to affect the system, the impression which it makes is characterized by slight vertigo, and sometimes pain in the head, dimness of vision, and dilatation of the pupil. In some cases nervous sensations are excited in the fauces, amounting even to a sense of suffocation, but more commonly producing only heat and thirst. Although not soporific like opium, it produces a slight tendency to sleep. On the circulation the effect is not very striking; in some cases increasing the frequency of the pulse somewhat, while in others it is rendered slower.* The bowels are moderately relaxed, and the secretion of urine increased. If it be given in somewhat larger doses, say three or four grains of the powdered leaves, in a few minutes it produces giddiness, nausea, difficulty of speech, with great thirst, with symptoms analogous to those of intoxication from alcohol.† Like belladonna, it uniformly dilates the pupil. This is the case especially when applied locally, either in the form of extract or watery solution. This effect comes on in about half an hour after its application, and continues for about two days.‡

In *poisonous* doses, the prominent effects are sickness at stomach, loss of vision, dilatation of the pupil, delirium,§ amounting sometimes to actual mania and stupor; in some cases spasms, and occasionally palsy occur. After continuing for a longer or shorter period, patients recover from these effects, although sometimes death is the result.

[I have seen perfectly well marked chorea produced in a child of eight years by swallowing the seeds of stramonium. The symptoms went off in about twelve hours.—Ed.]

Modes of Administration.—Powder.—Both the *leaves* and *seeds* are used—of the powdered leaves, the dose is from two to three grains—of the seeds, which are stronger than the leaves, one grain may be given twice a day.

Extract.—Of this there are two kinds, the one made from the *leaves*, the other from the *seeds.* The extract from the leaves is prepared by bruising the fresh leaves in a stone mortar, sprinkling on them a little water,

* See Experiments by Cooper, in Caldwell, p. 174, for 1805. † Ibid. p. 184.
‡ Cooper, p. 173.
§ For a striking illustration, quote from Cooper in Caldwell's Therap. p. 186.

then expressing the juice, and evaporating to a proper consistence. Prepared in this way it is, like all the narcotic extracts, apt to be uncertain as regards its strength, differing according to the mode of conducting the process of evaporation, and the season when the leaves are gathered. The average dose is about a grain night and morning, gradually increased until the system is affected.

The extract from the seeds is prepared by macerating a pound of the seeds in a gallon of boiling water for four hours; then taking out the seeds and bruising them, after which return them to the liquor; boil down to four pints, and strain while hot. After this evaporate to a proper consistence. The extract prepared in this way is about twice as strong as that from the leaves, and is more certain in its effects. The dose is from $\frac{1}{4}$ to $\frac{1}{2}$ a grain twice a day. This may be increased every day or two $\frac{1}{4}$ of a grain, until some decided effect is produced.

Tincture.—This is prepared by macerating four ounces of the bruised seeds in two pints of diluted alcohol for fourteen days, and then filtering. Of this the dose is from ten to twenty drops; may be taken two or three times a day, and gradually increased.

Ointment.—One pound of the leaves cut into pieces, melted with lard, one pound; yellow wax, half a pound.

Diseases in which it is used.—From the analogy in effect to the Belladonna, it has been found useful in very much the same kind of diseases.

Affections of the Eye.—In cataract, inflammation of the iris, &c., it is used with similar intentions and effects as the Belladonna already noticed.

Asthma.—In this disease the use of stramonium in the form of smoke is an old and popular remedy. In the spasmodic form of it, especially, it has been found beneficial during the paroxysm. It is not, however, infallible in its operation. In some cases I have found it exceedingly advantageous, while in others it has produced little or no effect. The mode of using it is to take the dried leaves and cut them into small pieces, and then smoke in a common pipe, precisely like tobacco. Used in this way, it produces all its narcotic effects on the system. For those who have been accustomed to smoking tobacco, two pipes a day will do to begin with, but for others, and females, a single pipe will be sufficient. As the system gets accustomed to it, the quantity may be increased to several pipes a day. As soon as nausea or vertigo come on the smoking should be suspended.*

Stramonium has also been used internally in asthma.

Epilepsy.—This was one of the diseases in which the stramonium was earliest used, and in the hands of some with considerable success, while in those of others it has not accomplished much. By Odhelius, a Swedish physician, fourteen cases of this disease were treated with it in the Royal Hospital at Stockholm. Of these eight were cured and five relieved, and

* Bayle, vol. ii., pp. 306, 308.

only one did not receive any benefit.* During its use the patients suffered transient headache, numbness, and obscurity of vision.

Neuralgia.—In this disease the success of stramonium has only been partial. By Leutin, a physician of Hanover, fourteen cases of tic douloureux were treated with this remedy without curing a single case.† By Dr. Marcet it was resorted to in three cases. In the first it cured the patient after several other remedies had been used in vain. It was given in doses of $\frac{1}{4}$ of a grain to gr. j of the extract from the seeds twice a day. In the second it caused so much affection of the head and stomach, and such general nervous agitation, that it was found necessary to abandon it without any benefit having been derived from it. In the third case it proved of much advantage for a time, but in consequence of the removal of the patient to a distance, the result was not known.‡ Dr. Bigelow of Boston, in one case of this kind, found it of great service.§

By Dr. Read of Massachusetts three cases are recorded, in all of which the stramonium effected a radical cure of the complaint. They were all of considerable duration, and various other remedies had been tried without any essential benefit. It was given in the form of extract, from $\frac{1}{8}$ to $\frac{1}{2}$ a grain.

* See Bayle, vol. ii., p. 266. Dict. Mat. Med. vol. ii. p. 595. Cooke on Nervous Diseases, p. 410.

† Bayle, vol. ii., p. 280.

‡ Trans. of the Med. Chir. Society of London, vol. vii., p. 570.

§ Eberle, vol. ii., p. 84.

ANÆSTHETICS.

This term is applied to agents which diminish or temporarily suspend the general sensibility of the body. The idea of controlling or diminishing the pain of surgical operations has long been a favorite one, and various means have at different times been resorted to with a view of realizing it. These attempts had generally failed altogether, or met with a very partial success till the introduction of ether inhalation. Sir Humphrey Davy had indeed reported his success in controlling pain in his own person by the inhalation of nitrous oxide, and Mr. Horace Wells made some trials, not altogether without success, with the same agent so early as 1844.* But it was not till 1846 that Dr. Morton of Boston, after many cautious trials on himself and some of his patients, induced Dr. J. C. Warren to use sulphuric ether inhalation in an operation at the Massachusetts General Hospital. This operation was performed Oct. 15, 1846. The anæsthesia was but partial. The next day another operation was performed by Professor Hayward, in which ether was used with the effect of rendering the patient completely insensible to pain. From this beginning the use of ether spread over the whole civilized world in an astonishingly short time, and from every quarter reports the most extravagant were promulgated of its wonderful success. In January, 1847, ether inhalation was first used to control the pains of parturition by J. Y. Simpson, M. D., of Edinburgh. It was used in Paris, Jan. 27, by Dr. Deschampes; and Feb. 8, in his Obstetrical Clinique by Dubois. In London it was tried first by Professor Murphy, Feb. 13, 1847, and in this country by Dr. Kemp, April 7, 1847.

* My attention was directed by my friend Prof. Ellet to the following passage in the works of Berzelius which contains the *germ* of the idea of anæsthetics of the general character of ether, chloroform, etc., viz. the compounds into which hydrogen enters largely. It is certainly curious, and all the more so in that it affords another striking proof of the possibility of a discovery being *almost made* long before its actual and practical realization :—

Une atmosphère composée de gaz oxygène et de gaz hydrogène substitué au gaz nitrogène rend, au bout de quelques temps, lourd et comme engourdi, mais ne produit pas d'autres signes de malaise. Allen et Pepys ont vu des cochons d'Inde qu'on avait laissés au milieu d'une pareille atmosphère, finir par tomber dans un sommeil profond. On a des exemples d'hommes qui, après avoir respirée pendant longtemps un melange de gaz hydrogène et d'air atmospherique, se trouvaient pris chaque fois de sommeil, &c.—Berzelius, tom. i. p. 85, Bruxelles, 1838.

Lorsque Allen et Pepys firent respirer des cochons d'Inde dans une atmosphère de quatre parties de gaz hydrogène et une partie de gaz oxygène, ces animaux ne tardèrent pas a être plongés dans un etat d'assoupissement, et tombèrent dans le sommeil, sans que du reste aucun symptome de maladie se manifestat en eux. Dans une experience faite à Stockholm par Charles de Wetterstedt, qui laissa respirer pendant un quart d'heure un melange d'une partie de gaz oxygène, et de quatre parties de gaz hydrogène à une fille de vingt ans, atteinte de phthisie pulmonaire, il arriva presque chaque fois que la malade, jusqu'alors tourmentée par l'insomnie, fut prise d'envie de dormir, et tomba dans un sommeil paisible, sans que du reste aucun changement survint dans la marche de la maladie.—Berzelius, tom. iii. p. 556.

Thus the use of ether in midwifery may be said to have spread over Europe and America in less than six months. In November, 1847, Dr. Simpson, after making very many experiments with various agents with a view of discovering some substitute for ether, was induced to prefer chloroform, and soon used it in a case of difficult labor, and with complete success. Introduced to the notice of the profession by a gentleman so distinguished it soon gained great favor, and for a time seemed likely to supplant the ether, but a terrible check was given to the use of this article in particular and to that of anæsthetics in general by the occurrence of several cases of death from its use. These cases very soon amounted to eighteen or twenty, all from chloroform, and the apprehension that many more were concealed by the criminal want of candor of those in whose practice they occurred, excited in the minds of many professional men a dread of the new practice, and as rapidly as it gained its favor anæsthesia lost a part of it, but not all. It continued to be used in severe surgical operations, in obstetrical operations, and by some in cases of natural labor. It soon became the subject of very vehement disputation, and objections of all sorts, *moral*, *medical*, and *theological*, were urged against it. But at length the practice, in some sort, recovered its ground, and now it seems to have established itself as a valuable, reliable, and, if cautiously used, a safe means of relieving our patients from the pain of surgical and obstetrical operations, and also of controlling several very severe diseases. This appears to me to be the present state of professional opinion on this subject.

Effects of Anæsthetics.—The first effect is stimulating; the ears ring, the patient is restless and sensible of confusion of intellect, a numbness is felt in the limbs, sometimes he is excited to violent efforts or loud shouts; this soon passes away and a sleep more or less profound follows; consciousness is lost, the muscles are rigid, and sensibility is only blunted. Next follow muscular relaxation and a deeper sleep, consciousness and sensibility completely gone, breathing sometimes stertorous, though regular; pulse regular. The next stage is irregular or interrupted respiration, pulse weak and fluttering, and no doubt if this condition is allowed to continue for a few seconds, respiration would be altogether and for ever interrupted and death ensue. These are the ordinary effects of the inhalation of anæsthetics, but there are very many irregularities in their order and degree. Sometimes the state of exitement is not at all noticeable and the system passes at once into profound narcotism. I once saw a lady plunged into a state of the profoundest anæsthesia, with weak, irregular pulse, snoring, and interrupted respiration, by making three or four inhalations of chloroform. The time was not ten seconds. This, however, is rare, and the probable cause of it will be alluded to hereafter. Very frequently the stimulating effects pass by so rapidly that they are hardly noticed, and certainly would not be were they not carefully watched for. Then again they are violent and long continued, so as to impede the inhalation very

much, and the patient is, if an operation be attempted while in this condition, more unmanageable than if no anæsthetic were used. Sometimes consciousness survives sensibility; this, though denied by Dr. Snow (Lancet, Feb. 12, 1848), is undoubtedly true. I have seen it very many times in labor, consciousness perfect, perceptions clear, yet sensibility to pain markedly diminished or completely destroyed. Irritation of the stomach and vomiting are not very unfrequent, especially if food has been recently taken. Sometimes sensibility seems to remain, though consciousness is lost; the patient screams or gives other evidence of suffering; but memory has no place for these sensations, for after returning consciousness the patient is utterly unaware both of the suffering and the manifestations of it he may have given. These are the chief effects of anæsthetics.

Modus Operandi of Anæsthetics.—That they are absorbed is beyond doubt; they have been found in the blood in very many cases. Being then conveyed by the blood to the great nervous centres, these in succession lose their power. The order in which they are affected is thus given by Flourens. First, the cerebral lobes lose their power and intellect is impaired; then the cerebellum is affected and the power of regulating locomotion lost; afterwards the spinal marrow, and sensation and motion are gone; lastly, the medulla oblongata, the motive power of respiration, breathing, ceases, and death is the result. This sounds very well, but it seems to me that any one who has studied this matter by the bedside will be quite unable to reconcile what he there sees with the ordo of M. Flourens. What, for example, was the state of the cerebrum and cerebellum in the Irishman operated on at London Hospital, who made faces and jokes while insensible of the pain of an amputation?* Is the cerebrum and cerebellum affected when a patient in labor takes the handkerchief from her attendant, presses it to her face and expresses in the warmest terms the relief from pain which it afforded her? All this must manifestly be restudied.

Circumstances modifying the effect of Anæsthetics.—On this subject we want facts. *Age* does not seem to contra-indicate their use, as Professor Gross says he has administered chloroform to patients of every age from sixteen months to seventy years without any evil effects. *Sex*, too, seems to have little influence, and if any such power belong to *climate* we are yet unable to appreciate it.

State of the System.—The only thing from which we should, *à priori*, expect a modification of the effect of anæsthetics is present pain, but I am not sure that there is any difference in the facility with which the Anæsthetic state is produced in the patient about to submit to a surgical operation and the woman actually suffering pain of labor at the time the anæsthetic is given. The one seems to me to pass into the anæsthetic state as readily as the other.

* Lond. Med. Gaz., Jan. 22, 1847.

States of the System unfavorable and favorable to the use of Anæsthetics.—The conditions under which anæsthetics are most likely to act irregularly are—1. Very great plethora; from the observations of Dubois and others, it would seem most prudent to remove this plethora before the agent is administered. Yet having done this, care must be taken as to the manner in which the anæsthetic is given, as it usually acts much more promptly immediately after a bleeding, or when the system is much reduced, than under other circumstances. In the case to which I have already alluded, where its effects were so rapid and so serious, the chloroform was given immediately after a free bleeding. 2. The presence of serious disease of the heart or great vessels has been by Mr. Wakley and others said to contra-indicate the use of anæsthetics. This has been denied —certainly the existence of such organic affection should make us pause and duly reflect on the question, and if we judge it best to use the anæsthetic, no doubt great care should be taken to shorten or avoid altogether the period of excitement.

Mode of Administration.—A very great variety of inhalers have been proposed. They have nearly all gone out of use, and ether is now almost constantly poured upon a cupped sponge and held over the nose and mouth, while chloroform is dropped upon a handkerchief and held in the same way.

Rules for the Administration of Anæsthetics.—1. The patient should not take food immediately before the operation. 2. The mind should be as far as possible calm and composed. 3. Quiet around is of the utmost importance—loud talking, addressing questions to the patient, &c., are all likely to interfere with the production of the anæsthetic state. 4. As to how rapidly the patient should be hurried through the state of excitement there is difference of opinion, and a different rule shonld prevail as the agent is ether or chloroform. If ether is used the stimulation is often troublesome, and the deeper stages of narcotism not readily produced. We ought therefore to hurry forward the process, place the cupped sponge over the nose and mouth, not pressing on the skin, but quite near, and urge the patient to take full free inspirations—let them follow each other as rapidly as is consistent with their being *full* and *deep*. As to chloroform, Prof. Simpson advises that the patient should be plunged as rapidly as possible into complete anæsthesia. This is not the course I would recommend. I think the practitioner will do better to feel his way a little, and allow the effects of the agent to develop themselves gradually. There will every now and then be trouble with the stimulating effects, but there will be less danger. 5. Care should be taken that the supply of atmospheric air is at all times adequate. There is little doubt but that several of the fatal cases depended on an inadequate supply of air. 6. Watch the case from the first inhalation till consciousness and sensibility have completely returned. One person should in all operations have charge of the anæsthetic, and he should *think of nothing else.* In one fatal

case the attendant who should have watched the patient was looking at the operation, *and the man died.* The person who has this charge should keep his finger on the pulse *every single moment* of the time—not one beat should the heart give that his finger does not take note of. The moment the pulse begins to flag or flutter the inhalation should cease, and a puff or two of fresh air be blown into his face. As to the degree to which the effects should be carried, it will differ in different cases. In natural labor we need ordinarily go no further than to obtund pain, and this can generally, I think, be done without disturbing consciousness. In surgical operations complete relaxation of the muscles and profound sleep is generally required. This state, however, must be watched, and when the breathing becomes stertorous the inhalation should be suspended. If the breathing is irregular or interrupted the danger is most imminent, and every means of keeping up respiration should be resorted to. Artificial respiration is the sheet anchor in such cases, and I have known great danger removed by prompt and continued artificial respiration. Everything will depend on the coolness and self-possession of the operator. 7. When the patient is allowed to emerge into consciousness everything that can startle or shock should be avoided, and the brain allowed quietly to recover its equipoise. Ammonia, oxygen, galvanism, &c., &c., have been proposed as remedies in excessive anæsthesia. They amount to nothing. Artificial respiration is the alpha and omega.

Applications to Disease.—In Surgical Operations anæsthetics are almost universally used. On this subject, having no experience of my own, as I do not practise surgery, I will quote the emphatic language of my distinguished friend, Prof. Gross. "I have never noticed in any of my cases that the use of chloroform exerted any injurious effects on the recovery of my patients." *

In Midwifery.—Here the fate of anæsthetics has been very different from that which it met in surgery. From its first introduction into obstetrical practice to the present time objections of all sorts have been urged against it, and evil consequences of all kinds attributed to it. *It was immoral,* for it excited in the patient indelicate ideas, and might prompt to improper words. *It was irreligious*—God had said to woman "in sorrow shalt thou bring forth children"—anæsthesia tried to escape this curse. It predisposed to hæmorrhage, to puerperal convulsions, to mania, &c. The child might be poisoned, made an idiot, &c., &c., To this a great deal of jargon has been added about pain being a "*conservative manifestation of life force,*" "*being physiological,*" and the like. These objections of course never had any weight, and having served their purpose of attracting attention to their authors, may now be charitably forgotten. But more tangible objections have been made to anæsthesia in midwifery. It is said to interfere with uterine contraction, and thus augment the dura-

* Trans. Am. Med. Ass., vol. iii. p. 392.

tion of labor. That the first administration of anæsthetics ordinarily checks pain is certain, but in almost every case it promptly returns, and is quite frequently more efficient, so that it is at least doubtful whether the duration of the process is greater; but even though it were, are not the advantages obtained worth the sacrifice? As to its evil influence *post partum*, I do not believe that there is existing any proof of such influence. The recoveries after its use are certainly as rapid and as satisfactory in every respect as those without it, and most practitioners who speak from any large experience think more so. But the great objection to anæsthetics remains. They have, and that in a very considerable number of cases, caused death. They are then dangerous to life—that is the great, the sole objection to them. This being certain, as I think it is, the question returns in this form: Are the advantages gained by the use of anæsthetics in midwifery sufficiently important to justify us in the use of an agent which may destroy life? What are these advantages?

1st. Immunity from pain. While the old adage that "pain is an evil" holds true, this will be by all rational persons admitted to be a very great advantage.

2d. Immunity from the shock which great physical pain often inflicts on the nervous system. This shock is, we know, sometimes so great as directly to destroy life; it very frequently produces a depressing influence, from which the patient does not rally for hours or days. This is seen after labor in nervous, delicate women, who, having large children, suffer very severely in parturition. In this state of things we are very frequently obliged to give narcotics, and even in some cases these fail for a long time to control the excited nervous system. Now anæsthetics prevent all this: opiates remove or control it. But is it not safer to prevent than control evil? Now, if this be true, if pain is not only an evil in itself, but if it and it alone can and does in any considerable number of cases endanger or destroy human life, we are surely justifiable in using a means of warding off that danger, provided the one to which we expose our patient is not greater than that from which we protect her? What proportions do these two dangers bear to each other? We have no statistics that enable us to answer this question confidently, and must, therefore, only answer it conjecturally. What is the danger attending the use of anæsthetics? The number of fatal cases authentically reported is, I believe, about twenty. To how many thousands and tens of thousands have anæsthetics been given? How very small, aye, and considering the careless way in which it was at first used, *how wonderfully* small is this proportion of fatal cases! On the other hand, what is the danger to life from the pain (mere pain) of childbirth? In natural labor and in healthy women infinitely small. In nervous, timid, excitable women (natural labor) not so very small. In cases of lingering labor, especially where the delay depends on a rigid perineum, the danger is by no means small; and when we come to the

severely painful operations, as turning, the forceps, removing retained placenta (hour-glass contraction), it is very considerable—much, much greater than the danger from anæsthetics. From these premises I deduce the rules as to the use of anæsthetics in midwifery. In natural labor, in patients of good constitution, free from nervousness, it need not be given. In the nervous, timid, excitable woman it may be given, even in natural labor. In lingering labor, where the pains are severe and the suffering great, it ought to be given. In severe operations it manifestly and indubitably increases the patient's chance of recovery, and may not justifiably be withheld.

In Delirium Tremens.—Anæsthetics have been used in this disease in very many cases, and generally with the most pleasant effects. It is often somewhat difficult to get the patient fairly under the influence of the agent (especially if ether be used), but once overcome, he is generally quiet, and the artificial usually passes into natural sleep, which continues for many hours; the patient generally wakes up calm and composed. In these cases care should be taken not to overwhelm the weak, exhausted system, but to introduce the anæsthetic somewhat gradually.

In Puerperal Convulsions.—After suitable sanguineous depletion, anæsthetics may be tried with the best effects. The violence of the spasms is promptly controlled, and the fit very often arrested at once. Here the caution as to the administration of anæsthetics immediately after bleeding, heretofore given, would apply.

In Spasmodic Asthma.—Anæsthetics have been given with entire and immediate relief to the paroxysm; of course they would produce no curative effect on the disease; but if they only give temporary relief to a fit, it is no small boon.

Idiopathic Tetanus.—Mr. Carey reports in the London Lancet (Feb. 1848) a case in which chloroform was used with success. It was administered so as to keep the patient under its influence for some time. Dr. I. Parrish, of Philadelphia, has reported another connected with erysipelas. It has also been used repeatedly in traumatic tetanus and hydrophobia, with the effect of mitigating the sufferings, though not prolonging the life of the patient.

In Neuralgia.—This is one of the diseases in which anæsthetics have been used most frequently, and with the greatest success. They very rarely fail to remove for a time the pain, and though on the patient returning to a conscious state the pain often returns, yet a repetition of the remedy usually removes it again; and after two or three such returns, the disease has in many cases been entirely removed.

INDIVIDUAL ANÆSTHETICS.

Sulphuric Ether.—This was the agent first used, and it continues to be the favorite with a small portion of the faculty. Its advantages are: 1st. It is more stimulating, and may therefore be given to patients very much exhausted, with a view to its stimulating as well as to its anæsthetic effects. Its main advantage, however, over chloroform is *safety*. Not more than one or two deaths have been satisfactorily traced to the use of ether.

Objections.—It is so stimulating that it is difficult to get some patients beyond the state of excitement. It has to most persons an exceedingly disagreeable odor, and this is very permanent. It excites coughing very often and headache not unfrequently. To some persons it is so disagreeable that they cannot take it. Still as it is, from the slowness of its operation, safer than chloroform, I would advise all persons to make their essays in the use of anæsthetics with ether; when repeated observations have given them *confidence based on knowledge*, they may try the more dangerous agent.

Mode of Administration.—Ether should be poured on a large cupped sponge, and this held immediately over the mouth and nose, but not pressed down upon the face. As soon as the respiration becomes deep and moderately slow, the sponge should be raised, that a larger proportion of air may enter the lungs; the impression can then be rendered deeper, if desired. The quantity of ether required to produce full anæsthesia is about an ounce, but much more is often used, part being wasted.

Chloroform.—This is in chemical language a Terchloride of Formyle. It was discovered by Soubeiran, in 1831, and Liebig, 1832. It consists of two atoms of carbon, three of chlorine, and one of hydrogen.

Physical Properties.—A clear limpid fluid, very volatile, boils at 140°. Sp. gr. 1.480, a pleasant fruit smell, and a sweet taste. It is not inflammable—has great power as a solvent.

Preparation.—It is usually made by the distillation of dilute alcohol and chloride of lime.

Adulteration.—It is often adulterated with alcohol, which may be discovered by testing the sp. gr. It should not be used if below 1.400. Sometimes it contains sulphuric acid. This may be detected by litmus paper, or the action of nitrate of baryta, on distilled water shaken with the chloroform.

Effects.—Chloroform is more powerful as an anæsthetic than ether in the proportion of about eight to one. It is far less stimulating, and the stage of excitement it produces is so short, if a full dose is administered, as scarcely to be perceptible; the patient passes almost instantly into sleep, more or

less profound. It sometimes excites nausea and vomiting, but very rarely coughing, choking, or any of those evidences of irritation of the air passages from which so much trouble is experienced when ether is administered. In fact, it is perfectly agreeable—very powerful—very certain in its effects, but also *very dangerous*, especially if not watched most assiduously.

Mode of Administration.—Chloroform is usually given in a handkerchief, twenty or thirty drops (not more than thirty) are poured on it, and the handkerchief placed about an inch from the face; the patient should be encouraged to take deep, full inspirations; a little agitation will soon be manifested, but this will generally pass away in a moment, and the patient will continue tranquilly and with apparent pleasure to inhale. Often, if efforts be made to remove it, they will be resisted; gradually the brain is oppressed, consciousness lost; next come muscular relaxation and deep, perhaps stertorous breathing. *Stop, now*, and let the operator do his work; if the patient rouse, give the chloroform again; a few deep inspirations will probably complete the insensibility. When it is desirable that the patient should revive, let this be without noise or confusion, and let consciousness return perfectly before any questions are asked or remarks made. Let me in conclusion beg every one who reads these directions never to use chloroform without having *the fingers upon the pulse every moment.* In no other way, I am quite sure, can danger be avoided. And I would beg those who read this caution to remember that it, and the representations of the danger of any but the most cautious use of this drug, come from one of the earliest and most earnest of the advocates for its obstetric use —one who uses it constantly and habitually in all his cases of obstetric operations—in most of those of lingering and painful labor, and in not a few of natural labor. Yet has my experience so taught me that I never touch this agent without dread, and am deeply conscious that nothing but unremitting vigilance has saved me from producing with it the most disastrous effects.

Chloric Ether.—This is a mere dilution of chloroform with alcohol, in the proportion of one of the former to eight of the latter. It is used exclusively by Dr. Warren at the Mass. Gen. Hospital; he thinks that it is more pleasant than sulphuric ether, and safer than chloroform. It has not the unpleasant smell of sulphuric ether, does not produce pulmonary irritation, and very rarely headache. It is more apt to produce nausea, which Dr. W. thinks rather an advantage than an objection. The opinions of this distinguished surgeon are worthy of all possible respect. Chloric ether is also employed by Dr. Knight of New Haven, and other surgeons at home and abroad.

Dose and Mode of Administration.—The same as sulphuric ether.

Chloroform and Ether.—A mixture of the two anæsthetics in pro-

portions of either one of chloroform to two of ether, or one to three is employed by Prof. Brainard of Chicago, Dr. W. Atlee of Pennsylvania, and some other surgeons. It is supposed to combine the excellences of both agents.

Other anæsthetic agents have been tried, but none have come into any considerable use.

[As Dr. Beck did not lecture on Anæsthetics, I have been obliged to supply this sketch.—Ed.]

STIMULANTS.

By Stimulants are meant that class of medical agents which possess the property of increasing the vital movements of the system at large. The general effects which they produce are simple and obvious; almost as soon as taken into the stomach, they produce a sensation of warmth in that organ, which more or less speedily diffuses itself over the whole body. The action of the heart and arteries becomes accelerated, and the pulse is more frequent and stronger. The muscular system is invigorated, while general energy is imparted to the brain and nervous system. In all cases these effects are temporary, differing in this respect considerably, according to the stimulant and the quantity used. Some are peculiarly evanescent in their action, others more permanent. All are followed by more or less languor and debility. Let us analyse a little in detail the effects of these remedies on the different parts of the system.

1. On the Brain and Nervous System.—The brain experiences a marked increase of power and activity. The senses, sight, hearing, taste, all become more acute. The intellectual faculties are roused, and the imagination more especially stimulated. The passions, too, become excited, and every good and evil propensity is roused into exercise.

2. On the Urinary System.—Here the effects of these agents are striking and peculiar. In the first place, they usually increase the quantity of urine secreted. This may be accomplished by the general impulse given to the circulation, involving the kidneys in the universal excitement. In the second place, besides increasing the quantity they alter its quality. It becomes high colored and irritating in its properties. This is evident from the heat and uneasiness which it occasions in all the surfaces over which it passes, when discharged from the system.

3. On the Skin.—In the general excitement of the circulation which takes place under the use of stimulants, there is no part which participates more decidedly than the skin. The capillaries become filled, heat is developed, and the secretion from the surface augmented.

CIRCUMSTANCES MODIFYING THESE EFFECTS.

Age.—This modifies the effects of stimulants in a very striking manner. Their power is always manifested in proportion to the degree of sensibility and mobility in the system. In early life their action is, therefore, much more decided than afterwards. When judiciously used, their effects are most remarkable in invigorating the system. When improperly given their evil effects are quite as decided. The reason of this is plain; in early life the circulation is naturally rapid and irregular, hence local congestions are so common. Now stimulants still further hurry the circulation and increase the danger of evil results. At this period, therefore, stimulants should generally be avoided. In old age, on the contrary, the circulation is sluggish, the system unirritable, the sensibility exhausted; here stimulants may be used with freedom, and their effect is less, but their use is unattended with the dangers which it has in infancy and childhood.

Sex.—From the greater delicacy and excitability of the female system, stimulants produce a more decided effect on women than they do on men. Besides the general difference of constitution, there are other circumstances in the female which modify the effects of stimulants. This is especially the case during pregnancy. In this condition of the female system there is always increased excitement present. Hence it is very evident that the general effect of stimulants must be very different from what it is in the ordinary state of the system, and such is the result of experience. This is more fully treated under the head of *Tonics.*

Temperament and Constitution.—In sensitive and sanguine temperaments stimulants produce more excitement than they do in the melancholic and phlegmatic. In the application of this class of agents to the treatment of diseases in different constitutions this fact is always to be borne in mind.

Climate.—Of all the circumstances modifying the effects of stimulants this is, perhaps, the most striking. The inhabitants of Northern regions, whose sensibility is blunted by the rigor of the climate, can bear much larger quantities of ardent liquors than those of warmer latitudes. The apathetic Russian, for instance, can take with impunity what would prove inevitably destructive to the sensitive inhabitants of the South of Europe. Even in our climate temporary exposure to the benumbing influence of cold will produce a similar effect. A person thus exposed may safely take, without any, or at least a trifling effect, what would be sufficient, under other circumstances, to intoxicate him.

Repetition.—The same general law holds good here that is found to prevail in other classes of agents. The system becomes gradually habituated to the impression which they make, and to produce the same effect larger quantities require to be administered. Illustrations of this fact are familiar

to everybody. It is exemplified in the history of every person addicted to the use of intoxicating liquors. I once knew a man, now dead, who began his career of intemperance by taking brandy in drops. What the number of drops was at first I do not know. He did this with the intention of its serving as a check upon any excess into which he might be tempted. Finding, however, as a matter of course, that the exhilarating effects of his drops were gradually lessening, he increased the dose, and in this way he went on practising a constant deception upon himself until he became a perfect sot. In the use of stimulants in the treatment of diseases this fact is of importance. It shows that when they are required the dose must be gradually increased, if you wish to keep up a certain effect.

Actual Condition of the System.—The effects of stimulants vary continually with the varying condition of the individual. If the stomach is empty, they are much greater than when it is full. This is known to everybody. Double the quantity of liquor of any kind can be taken after dinner than before. The reason is, that the excitability of the stomach is, to a certain extent, exhausted by the process of digestion. This is evidenced by the tendency to torpor and sleep which succeeds this process. A still more striking illustration is met with in persons who, either from necessity or inclination, have fasted or kept themselves on short allowance for any length of time. In these cases, from the accumulated excitability in the system, the smallest quantity of stimulating food or drink produces the most extraordinary effect. The celebrated Venetian nobleman, Cornaro, who attained to the age of upwards of 100, by his abstemious mode of life, relates that he had a violent fever excited, which lasted for several weeks and threatened his life, by simply increasing the quantity of his daily allowance of food from twelve to fourteen ounces.

Another interesting case occurred in the history of Captain Bligh, who commanded the ship Bounty. In her voyage in 1787 to the South Sea Islands to convey the bread fruit tree to the West Indies, the men mutinied, and the commander with eighteen men was sent adrift in an open boat. In this condition they performed the unparalleled voyage of 4,000 miles in the open sea. Their sufferings during this period from exposure and want of food were dreadful. They were kept all the time in a state nearly approaching that of starving. In this state a *teaspoonful* of rum dealt out to them occasionally is stated to have acted as a powerful stimulant in invigorating and enabling them to complete this extraordinary voyage without the loss of a single individual.

In the third place, another illustration of the modifying effect of the actual condition of the system is to be found in those cases where the excitability, instead of being accumulated, has been from some cause or other exhausted. Here immense quantities of stimulating articles can be taken with little or no effect. The advanced stages of typhus furnish many examples. In these states of torpor and insensibility it is astonishing

what immense quantities of wine and other stimulants have been administered with but little effect. But it is unnecessary to go into any further illustrations. Every disease furnishes one.

STATES OF SYSTEM FAVORABLE AND UNFAVORABLE TO THEIR USE.

As the effects of stimulants differ so materially according to the actual condition of the system, it is exceedingly important to mark, if possible, with some precision, those in which they may be used with advantage, as well as those in which they may prove injurious.

(*a.*) A state of active irritation or inflammation of the stomach is decidedly unfavorable to the use of stimulants. Whenever, therefore, this state of the stomach exists, you are to avoid these agents. In speaking of irritation of the stomach, you are to make, of course, a proper distinction. In many cases this organ becomes exceedingly sensitive and irritable without the least inflammation. You see this in cases of ordinary sea-sickness; in the sickness resulting from the use of narcotics, tobacco, &c. Here stimulants, so far from being objectionable, are the best things that can be used.

(*b.*) The existence of active local irritation or inflammation in any other part of the system is decidedly unfavorable to the use of stimulants.

(*c.*) The existence of general febrile excitement is unfavorable to the use of stimulants. If given their certain effect must be to increase vascular excitement, and perhaps bring on local congestion.

I do not wish you to understand by this that I consider every state and stage of what is commonly denominated fever as improper for the use of stimulants. On the contrary, in the advanced periods of the disease, where the energy of the nervous system is exhausted, and a general collapse has taken place, this class of agents is essential, and they may and must be given in very large quantities, as before stated.

(*d.*) General plethora of the system is unfavorable to the use of stimulants. In this state there is always danger of some local embarrassment, either in the way of congestion or inflammation, whenever any exciting cause is applied to hurry the circulation beyond its natural velocity. Now, stimulants act directly as such an exciting cause. They quicken the circulation at a time when the heart and blood-vessels are so distended as to be unable to carry the blood freely through the system. Hence obstructions take place, and apoplexies and the like result.

(*e.*) Organic disease of the heart and arteries is unfavorable to the use of *stimulants.* The hurry and vehemence with which circulation takes place under the influence of stimulants would always tend to increase organic disease, and endanger rupture of the vessels in case of aneurism.

From all this the condition of system favorable to the use of stimulants

is evident. It is that in which there is general constitutional debility or nervous exhaustion, unaccompanied by local inflammation, or local embarrassment, or organic disease.

With these general observations I shall, after a word or two on the difference between stimulants and tonics, pass at once to the consideration of the application of these to the cure of disease. The points of resemblance between tonics and stimulants are, that they both tend to augment the vital powers, to increase muscular strength, and to invigorate every part of the system. The differences are:

1st. Stimulants act with greater promptness; their effects follow almost immediately on their administration. Tonics, on the contrary, manifest no influence at all upon the system, till they have been used for some considerable time.

2d. The effects of stimulants pass off as promptly as they are induced; while of tonics, as the impression is slowly made, so it passes away slowly.

3d. They differ in the degree in which they excite the vital powers. By stimulants this excitation is very great; vital powers are augmented, and vital functions are performed with a degree of vehemence, so to speak. From tonics no such effects result; the exaltation of the vital powers which they produce is moderate; no violent action follows their use, nor can this effect be produced by any mode of administering them. Increase the dose of a stimulant, and you increase its stimulating power; increase the dose of a tonic, and its effects are no longer tonic, they are in a high degree irritative.

Before passing to the application of stimulants to the treatment of various diseases, I will give you a few general rules for their administration. This is the more necessary, as there is perhaps no class of medicines which vary so widely in their operation according to the mode in which they are given. This, indeed, often entirely decides the question whether they are to do good or harm, to save or to destroy. Administered judiciously, there are few remedies more valuable. Given carelessly, there are none more dangerous.

Rules to be observed in the use of Stimulants.—1. Begin with small doses, and increase them only as they obviously fail of producing the desired effect. In this way you will often get from a moderate amount the best effects, and you avoid the very great evil of being obliged to oppress the stomach by a large quantity.

2. Change the stimulant as the system becomes accustomed to it. When it no longer responds promptly to the impression of one form of ardent spirits, try another; if beer after doing well for a time loses its power, resort to wine, and so on. You will often find that the system when it has become quite insensible to the impression of one stimulant, will be roused by another, even though feebler in its general action. This shows a

diversity in the impression made by different articles of this class, and proves the fallacy of that theory of the operation of stimulants which gives to them all a uniformity of action, and allows only a difference in degree between one and another. If this were so we should need but one stimulant, and could get all the effects of the class from one individual article. Every day's experience disproves this idea.

3. That you may avail yourself of the advantage to be derived from following the last rule, use stimulants uncombined. Give one form, and only one, till the system ceases to respond to it, and then resort to another to be used in the same way.

Practical Applications of Stimulants.—There is, perhaps, no class of remedies which has been more abused than the one we are now considering, and there is none which require more discrimination in their use. The reasons of this are obvious. The general indication for which they are given is to remove debility, either of some particular organ, or of the system at large. Now, debility may exist along with many different and opposite conditions of the system. It may be apparent, or it may be real. It may be the result of excessive action and inflammation, or of deficient action. Now, if stimulants be given in these various conditions of the system merely with the view of counteracting debility, the most opposite and disastrous effects must be produced. It is evident, then, that the mere presence of debility is no guide to the use of these agents. In all cases, the accompanying state of the organs and the cause of the debility must be taken into consideration. This shows the necessity of extreme caution in their use. All this will be strikingly illustrated in noticing some of the diseases in which stimulants are prescribed.

1. Fever.—There is no form of disease in which there has been a greater difference of opinion in relation to the use of stimulants than in fever. While by some they have been freely used, and even considered essential to the cure, by others they have been totally interdicted. That these opinions on both sides have been carried to an unwarrantable extreme, cannot be questioned by any one who has been governed in his conclusions more by observation and experience than by mere theory. The cause of this difference of opinion and practice cannot but be obvious, and it is this—that the treatment has been deduced in too many cases too rigidly from certain theoretical notions which have been entertained in relation to the nature of fever. Thus for example, by the Brunonians, fever was looked upon as a disease of debility, and accordingly stimulants were proper remedies. On the other hand, the Broussains, discarding altogether the idea of the existence of fever as an idiopathic disease, and looking upon it as always the result of local inflammation, considered antiphlogistic remedies as the only ones proper. A more enlightened observation has shown the fallacy of both these doctrines. Fever is not to be considered as

a disease of pure debility, or as originating in local inflammation, and yet in the different forms and stages of it both these may be present. In its varied and protracted career, fever presents phenomena entirely different, and these require a corresponding difference in the treatment. In the early stages, where the prominent symptoms are increased—action of the heart and arteries, heat of skin, impaired secretion—stimulants are obviously improper; bleeding, purging, and other antiphlogistics are essential, but in the progress of the disease, sooner or later, symptoms of sinking and collapse come on, and here the very free use of stimulants may be required to preserve life. This will not happen in every case, and generally speaking patients do vastly better even in the last stages of fever without stimulants; especially is this the case in the intermittent and remittent fevers which prevail throughout our country. In typhus the case is widely different, and stimulants are much more frequently required. In the last stage, where general torpor and collapse exist, the judicious use of stimulants is exceedingly beneficial, and from the great insensibility that prevails we are frequently warranted in giving them in very large quantities. Both the quantity given and the continuance of the remedy must depend on the effects which it produces; it is, therefore, essential that the patient be carefully and intelligently watched.

Where under the use of stimulants the pulse becomes slower and fuller, the skin uniformly warm and moist, the respiration more equable and slow, the tongue moist and clean, delirium abates and sleep follows: the stimulants are doing good. Where on the contrary the pulse is quickened, face flushed, heat augmented, thirst and restlessness produced, and delirium either comes on or is aggravated, the stimulants are failing of their proper effects, and should be stopped. Dr. Stokes says that the use of wine is indicated when in typhus the heart's impulse is diminished, with feebleness or extinction of the first sound. The state of the heart's action is to be noted by the stethoscope, not by examination of the pulse.—*Dublin Jour.* 1839.

As to the quantity of stimulant that may be required there can be no fixed rule; the effect, and not the quantity should guide us. The previous habits of the patient will afford some indication. The particular stimulant to be used must also depend on circumstances. Sometimes snake root and volatile alkali will suffice, then brandy in the form of grog, milk punch, &c., &c., must be given with a liberal hand. To control the effects of those poisons which operate by a purely sedative influence, stimulants may be used with very great freedom, and with excellent effect; e. g. Ammonia has, in this way, controlled the action of the poison from venomous snakes.

HÆMORRHAGES.—In no case are stimulants more obviously necessary, and very seldom do they so plainly show their curative powers, as in rous-

ing patients from the prostration consequent on the loss of blood. The most striking illustration of this is in the Hæmorrhages after parturition. Here the prostration is frequently so great as to require the administration of large quantities of the most potent stimulants to save life. In some cases, even after the hæmorrhage has ceased, the patient will become pulseless; faintness comes on, nausea and vomiting supervene, and almost everything is rejected from the stomach. Even wine will be thrown off. In this state of things nothing but brandy, judiciously administered, will answer. Small doses of this mixed with water, and frequently repeated, will remain on the stomach, and support the sinking powers when everything else fails. The beneficial effect of it is to be judged of by its lessening the morbid frequency of the pulse.

3. Delirium Tremens.—This peculiar disease will be noticed when speaking of the effects of alcohol on the human system. The general mode of management will also be treated of. With regard to the use of stimulants there is much difference of opinion. By some they are supposed to be wholly unnecessary, while others consider them as essential. Everything here depends upon the precise character of the case. Where the patient is not broken down by long continued intemperance, and where there does not appear to be any particular prostration of strength, I conceive stimulants to be not merely unnecessary, but injurious. Moderate purging, keeping the patient in a dark room, abstracting all irritants, in the way of company, &c., together with the judicious and *moderate* use of opiates, will almost always prove competent to a cure. In a large majority of cases this treatment, variously modified to suit particular circumstances, will answer. At the same time cases may and do occur, where the general prostration is so great as absolutely to require some cordial or stimulant to support the sinking vitality, to preserve life from moment to moment. These cases, however, do not occur so often as is supposed; and I am inclined to think that this complaint, as a general rule, can be managed with much less free recourse to stimulants than is commonly supposed.

4. Dyspepsia.—In the whole range of medicine there is, perhaps, no disorder which has given rise to such various and contradictory treatment as this. The reason is obvious, when we reflect upon the endless and variegated symptoms to which it gives rise in its protracted career. Among the agents most commonly resorted to are stimulants of various kinds. In no disease have they been more abused, and in none has their use led to more serious and melancholy consequences. The temptation to their use on the part of the patient is always great and present. Generally speaking they give temporary energy to the stomach and to the system, and in this way induce the patient to believe that they are absolutely essential to

enable him to perform the process of digestion. Thus habits fatal to life and character have been contracted. Indeed instances of this kind occur so frequently that it becomes a question, not merely of professional but of moral interest, whether this class of remedies are ever necessary, or ought to be prescribed. Now it is very evident that a question of this kind can only be settled satisfactorily and correctly by understanding accurately the nature of the disease; unless this is done everything that may be said in relation to it amounts to little else than idle declamation. It is out of my province to give you anything like a full account of this protean disease. I shall content myself with such general statements as will enable you to judge how far stimulants may or may not be useful and proper.

Dyspepsia consists essentially in a debilitated and disordered state of the stomach. From the sympathy, however, existing between the stomach and the neighboring organs, such as the intestines, the liver, &c., the stomach cannot long be affected without involving these organs. Dyspepsia, too, may originate from different causes. It may originate from influences acting immediately on the stomach, such as excessive eating or drinking, or it may originate from diseases of some neighboring organ, as the bowels, the liver, &c., &c.

From all this it is obvious that this affection is necessarily of a mixed and complicated character, varying greatly in the different forms and combinations in which it may present itself. Besides this, it is to be recollected that its general character must be modified greatly by its duration. At first amounting to nothing more than functional disorder and simple irritation, it speedily assumes the character of insidious inflammation, and eventually terminates in chronic organic disease. If all this be true, it is very clear that no one uniform system can be applied to this disease. It must vary with the cause producing the disease, as well as with the extent to which it has proceeded.

The only condition connected with this disease in which stimulants can be serviceable or even admissible, is that of *simple debility* of the stomach and intestines. When this exists independent of other disease, and when there are no febrile or inflammatory symptoms present, they may be used; but even here with moderation, and not unfrequently the patient gets along better without them by trusting to regimen and exercise. Mackintosh says, "the best diluents he can use are, an infusion of camomile flowers and lemon peel, and wine and water; stimulants are to be commenced with great caution, and not until the pain in the epigastric region and heat of skin are subdued; perhaps the best stimulant is cayenne pepper with food, which affects the whole bowels as well as the stomach, and tends to obviate constipation. Ginger tea will be found serviceable, together with a glass or two of good sound wine once or twice a day. Wine sometimes, however, produces acidity, in which case a small quan-

tity of brandy and water is found an agreeable substitute."—Practice of Physic, v. ii. p. 235.

5. Convalescence.—In convalescence from disease the use of stimulants has been and is still resorted to. By some, indeed, they are considered essential. This is called *building up the patients*, and is as regularly resorted to as is the depletion and evacuations which precede it. With much more propriety might it be called *building up the physician*, for I have known more than one practitioner who owed a great portion of his success in business to this practice of *building up his patients*. Why it should render a physician popular is obvious enough: independent of the pleasurable excitement which is produced and repeated at each repetition of the dose, most patients are anxious to see and feel their progressive improvement, and this they imagine the stimulant enables them to do. With regard to this practice you cannot be too cautious. In some cases when disease has been long protracted, and when the powers of life have been greatly prostrated, gentle stimulants may be necessary. As a general rule, however, patients during convalescence will do much better if their recovery be trusted to the powers of nature, along with proper diet and exercise, than they will if goaded by the incessant use of stimulants. Their recovery may be slow, but it will be surer and unattended by any injurious effects. There are two reasons more especially why physicians should be cautious in this matter: 1st. It renders convalescence more uncertain. Stimulants hurry the circulation and drive forward vital action. Now when, as during convalescence, the vital powers are weak, the overtasking them is very apt to be followed by exhaustion, hence dangerous prostration. But there is another danger from the perturbing influence of stimulants on the circulation, viz. the unequal distribution of the blood, leading to congestion. This is especially to be dreaded where the convalescence is from some local phlegmasia, the organ that has been the seat of the disease is in a state very favorable to the occurrence of congestion or even inflammation.

2d. The moral danger from taking stimulants during convalescence is very great. Under no circumstances is their use so seductive as in convalescence, never are their immediate effects more pleasant, never is the call for another and another dram more irresistible. Sickness, too, removes one of the great safeguards against the habit of intemperance. Here the fatal cup is always *taken as a medicine*, and this idea will hide from the patient and his friends the approaching danger, till the fatal habit is fixed for ever. Avoid, then, this dangerous practice of giving stimulants during convalescence. I do not say that it is never necessary: it is; but you should always look upon it as a *necessary evil*, to be got rid of at the earliest possible moment. The rule is, never give stimulants when your patient is steadily, however slowly, gaining ground; if you are sure he is

a little, be it ever so little, better every day, trust to time; far, far better is it that a hundred patients should remain in bed a week longer than they would have done had stimulants been used, than that one should by your means have been *made a drunkard.*

In concluding the subject of stimulants I would say that deeming them, though of limited use (and you have seen that I am most anxious to limit their use), yet occasionally beneficial and sometimes essential, I have not hesitated to say so. I am aware that making this avowal, I expose myself to the abuse of the ultra temperance people. But I have a duty to perform, and besides, the cause of truth can never be promoted by sacrificing one's sense of right to any notions, however popular.

Gentlemen, I am as much in favor of temperance as any one, and I look upon the temperance reform as one of the great moral triumphs of the age. But so good a cause does not require to be supported by a violation of truth: the unchastened zeal of many so called temperance men has already done much mischief, and I fear will do much more.

As an illustration of this senseless zeal I may mention that a young man lately wrote a thesis in which he laid down the rule that alcoholic drinks were never to be used; that it *were better to let the patient die.* I need not stop to tell you what a monstrous doctrine this is. The duty of the physician is positive and specific, to save life; and yet according to this notion he is, for the sake of a remote and uncertain consequence, to violate this duty and let a human being die, when he could have saved him. Why, upon the same principle, when you see a drunkard or an immoral man drowning you may refuse to save him because the world would be better without his bad example. Such logic I do not understand; I am sure it is not the logic of the Bible: the whole spirit and authority of that book go to enforce the rule that we are to do our duty, and leave consequences *to an overruling Providence.*

INDIVIDUAL STIMULANTS.

Stimulants may be divided into those which are *local* in their operation, or which act more especially upon the stomach and bowels, and those which are *general* or *diffusible.*

The principal local stimulants are Ginger, Calamus, the aromatic seeds, Cloves, Mace, Cinnamon, Lavender, Peppermint.

The general stimulants are Alcohol, Ammonia, Camphor, Serpentaria, the peppers.

LOCAL STIMULANTS.

Ginger.—*Amomum Zinziber.*—The ginger is a native of the East Indies, and derives its name from Ginji, a mountainous district, where it is particularly abundant. It is also naturalized and cultivated in the West Indies and in Mexico. The plant grows to the height of two or three feet and has a tuberous root in which the active properties reside. This is the part used. "In the West Indies the ginger crop is gathered in January and February, after the stems have withered. After having been properly cleansed the root is scalded in boiling water in order to prevent germination, and is then rapidly dried." In this process it becomes blackened, and this constitutes the common *black ginger* of commerce. It is also imported from the East Indies, and is known by the name of the *East India ginger*. What is called the *white* or *Jamaica ginger* comes from Jamaica and is prepared by selecting the best roots, and taking off the epidermis and drying them carefully in the sun. It is then carried to England, from whence it is brought to this country.

Properties.—The dried ginger as found in the shops is round and knotty, and about the size of the finger. Externally it is covered with a dark-colored and wrinkled epidermis. Internally its substance is yellowish white. The white ginger differs from this only in having the epidermis taken off. It is of a yellowish white color externally and smaller in size than the black ginger. Ginger yields a powder of a yellowish white color. It has a pungent aromatic odor of a peculiar kind, and a hot, biting taste. Long exposure to the atmosphere dissipates these properties.

Effects.—A pleasant cordial stimulant to the stomach, producing a sense of warmth in the organ, with some excitement of the system. It is said specially to stimulate the respiratory and genital organs. Its use is chiefly as a condiment. As a medicine it is sometimes given to remove flatulence or nausea, or combined with purgatives to correct griping. In the colic of young children it may be used with advantage.

Dose.—Powder, 10 grs. or more. Generally used in an infusion.

Acarus Calamus.—This is the *sweet scented flag*, a plant growing abundantly in Europe, India, and America. In the United States it is indigenous and is found along the borders of creeks and rivulets. It is also frequently an inhabitant of swamps and moist grounds. The part used in medicine is the *root*. This is long (being from six to twenty-four inches), rough, and jointed. It runs horizontally, and is from half an inch to an inch thick. The root is taken up and simply dried and is then fit for use. By the process of drying it becomes diminished in size, but neither improved in its smell nor taste.

Properties.—As found in the shops the roots of this plant are of vari-

ous sizes; externally of a yellowish brown color; internally whitish and of a spongy texture. Sometimes in the root which is found in the market, the external covering has been entirely pared off, and nothing but the internal part left. Its smell is pleasant and aromatic. Its taste, when first chewed, sweetish and aromatic, but afterwards becoming bitter and acrid.

The active properties of calamus are extracted by boiling water.

Effects.—This plant has been celebrated for its medicinal virtues from time immemorial. It appears to have been known to the Greeks and Arabians, as it is noticed both by Dioscorides and Avicenna. According to Dr. Ainslie, "it is a very favorite medicine of the East Indies."

It is now little used except as a stomachic and carminative.

[The aromatic seeds, anise, carui cardamoms, the peppers, piper nigrum, capsicum, and allspice; the condiments, as cloves, lavender, peppermint, &c., are all remedies of much the same character as ginger and calamus; their physical qualities are well known to you all, and their use, whether culinary or pharmaceutic, probably familiar. They need not detain us.—Ed.]

GENERAL STIMULANTS.

Alcohol.—I come now to treat of alcohol—a subject which in its medicinal and moral relations is one of very great importance, and I shall therefore dwell upon it somewhat in detail.

Origin.—The juices of certain vegetable substances, when subjected to the action of air and moisture, undergo what is called *vinous fermentation*, and are then found to yield various liquors possessed of stimulating and intoxicating properties. Thus, the grape yields wine, the apple cider, &c. Now, these liquors contain, in various proportions however, a peculiar fluid called *alcohol*, combined with coloring matter and other principles. If they be subjected to another process, that of *distillation*, what is commonly called *ardent spirits* is obtained—brandy, rum, gin, whiskey, &c. These contain alcohol, mixed with water and volatile oil, &c., and to the quantity and peculiar nature of these additional ingredients are owing the difference of color, flavor, &c., which characterize different ardent spirits. By subjecting these again to a second and perhaps third distillation, the alcohol is obtained in its pure state, separated from all the other ingredients with which it is associated in wines, fermented liquors, and ardent spirits.

When the distillation of spirit was first invented is not precisely known. The term alcohol is of Arabic origin, and hence it has been supposed to have been discovered by the Arabians. "The Greeks and Romans were ignorant of ardent spirits; but the use of the still was well known in the time of Geber, who lived in the seventh century, who describes very accurately the process of distillation by the Alembic, *per descendorium, et filtrum*, in his work entitled *Liber Investigationis Magisterii*. The first

spirits known in Europe was made from grapes, and sold as a medicine both in Italy and Spain under the name of *alcohol*. The Genoese afterwards prepared it from grain, and sold it in small bottles at a very high price, under the name of *aqua vitæ*."—Thompson Dis. p. 572.

Pure alcohol is a colorless fluid, has a fragrant odor, and a hot, pungent taste. When exposed to the atmosphere it speedily evaporates; it is extremely inflammable, burning with a blue, lambent flame, without any sensible smoke; it boils at 173°; has never been frozen; it dissolves a great number of saline bodies, and is the proper solvent for most of the proximate principles of vegetables. It is lighter than water; the difference between them becoming greater in proportion to the purity and concentration of the alcohol. Hence, the best test of its purity is its specific gravity. Prepared in the usual way, the specific gravity is ·835, and this is the strength which it is ordered in the Pharmacopœia. By careful rectification, however, it may be obtained of the specific gravity of ·815, and even ·800. Besides the property which alcohol possesses of dissolving a great variety of bodies, it prevents the putrefaction of animal and vegetable substances. What is called *diluted alcohol* contains about equal weights of alcohol and water, and the specific gravity is ·935.

Effects of Alcohol.—In speaking of the effects of alcohol, I shall consider it: 1. As a *medicine*, and 2. As a *poison*.

In its pure state alcohol acts as a powerfully irritant and caustic poison. To whatever part of the body it is applied it causes contraction and condensation of the tissue, and gives rise to all the symptoms of local inflammation, pain, heat, redness, and swelling.

In its diluted forms (as in wine, brandy, &c.) when taken into the stomach, it produces the effect of stimulating the part to which it is applied, creates warmth, and promotes the flow of blood. A temporary excitement is thus produced in the organ, the appetite is increased, and the general power of it augmented. Succeeding this local impression, the general system is affected, the action of the heart and arteries is increased, the brain and nervous system are stimulated, and there is a general feeling of increased mental power and muscular energy; animal heat is developed, and the various secretions are promoted.

These are the effects, when used in moderation, and when it operates kindly. By a law of the animal economy excitement is always succeeded by collapse and depression, and so it is here. The excitement and energy produced by alcohol are followed by languor and debility, and these are always in proportion to the intensity of the preceding excitement.

Now, there are two or three circumstances connected with these effects which are worthy of notice.

1. The effects of alcohol are always proportioned to the excitability of the system. Hence, in young persons, in females, in nervous and sanguine temperaments, they are always the most decided.

2. The system becomes gradually accustomed to the impression made by this agent, and to produce the same effect requires larger and larger quantities.

3. In consequence of the agreeable excitement produced by alcohol, and the subsequent collapse, a desire is created for the repetition of the article. This is peculiar to alcohol, and is not the case with any other medicine, except perhaps opium.

As a medicine, alcohol in its various forms is an agreeable and powerful stimulant, and may be resorted to in all those cases where it is necessary to support the sinking powers of the system.

In consequence of the great abuses of this article, a question was some time since raised whether it was justifiable in a physician even to prescribe it in the practice of his profession. By many the opinion was entertained that it ought never to be resorted to, and that we could get along very well without it. I was myself asked, not long ago, to sign a paper declaring that alcoholic stimulants were never necessary in the treatment of diseases. I told the gentleman who handed it to me that *I did not believe it.* He urged me, notwithstanding, to sign it, insisting on the good it would do. I told him that I chose to be governed by the old Bible rule, never to do evil that good might come of it. Now, to put your name to a thing you do not believe *is evil*, and you are never justified in doing it. *Follow the Bible*, and you will never go wrong. Questions of duty are there resolved, not according to the fluctuating notions of the day, but by the immutable principles of truth.

As to the question whether we could *get along* without alcoholic stimulants, it is not worth discussing. We might as well ask, could we get along without opium or quinine.

Mode of using Alcohol as a Medicine.—In its pure state it is never taken internally. It is always used in combination in the form of wine or some other liquor, of which it forms the active ingredient.

1. *Wine.*—This is of various kinds, differing not merely in strength, but in its effects on the system. According to analysis, *Port* wine contains the largest proportion of *alcohol*, having about 23 per cent. Next to this is *Madeira*, which contains about 22½ per cent. *Sherry* contains 18 per cent.; *Claret*, 14½; *Champagne* (red) 11.30—(white), 12.80; *Burgundy*, 11½. Although champagne contains less alcohol than most of the other kinds of wine, it is proportionately more intoxicating in its effects. This is owing to the large quantity of carbonic acid gas which it contains. Besides their strength, wines differ in other respects. *Madeira* contains a good deal of acid, and therefore is objectionable where there is acidity of the stomach, or where there is a disposition to lithic acid depositions in the urine. *Sherry*, on the other hand, contains little or no acid. *Port* is astringent and tonic, hence it is well suited to cases in which the bowels are relaxed. *Claret* and *Champagne*, on the contrary, are laxative.

2. *Ardent Spirits.*—These do not differ materially in strength. *Brandy* contains 53·39 per cent.; *Rum*, 53·68; *Gin*, 51.60. They differ somewhat in their effects. *Brandy* is tonic and astringent. *Rum* is sudorific, while *gin* and *whiskey* are diuretic, especially when taken weak; the degree of dilution exerts a controlling influence over the effects of all forms of ardent spirits.

3. *Fermented Liquors.*—*Cider* and *Perry* contain 9·87 per cent; *Ale*, 8·88; *Stout*, 6·80. These, too, differ markedly in their effects, aside from mere stimulation. Ale and Porter are more decidedly tonic; Cider diuretic; Perry is scarcely known among us.

I come now to speak of alcohol as a *poison*. Like others, this may act as a *quick* or a *slow* poison. In the first way, from taking too large doses at one time. In the second, from continuing the use of moderate doses too long, resembling in this respect corrosive sublimate. Now, all these effects ought to be well understood by the physician, because they are all actual states of disease, and call for medical treatment just as much as poisoning by arsenic or opium. I shall therefore describe them, and at the same time speak of the mode of treatment.

1. When taken in a large dose at once, alcohol operates as a deadly poison. Mr. Brande injected proof spirit into the stomach of a rabbit, and in five minutes he lay motionless and insensible, the respiration was laborious, and in one hour and fifteen minutes he was dead. In animals killed with this poison, the stomach is of a cherry red color.

In the human subject, taking large quantities at once (as persons do who drink for a wager) coma comes on suddenly, the face is sometimes livid, more generally ghastly pale, the breathing is stertorous, the pupils sometimes contracted, more commonly dilated and insensible, and if relief be not offered speedily, death takes place sometimes almost immediately, at others after a few hours.

It is not in this way, however, that alcohol is generally taken. It is used in smaller quantities and taken more gradually, and then it produces various striking effects.

1. The first of these is *intoxication*. This is an effect peculiar to alcohol. There are, it is true, other agents which produce a sort of inebriation, such as opium, stramonium, camphor, nitrous oxide, the inhalation of sulphuric ether, chloroform, etc., but this is different from that produced by alcohol, both in its general phenomena, as well as in its results. A *paroxysm* of intoxication may be divided into three stages. During the first the system is only pleasurably excited. The impression made imparts energy to the mind and vigor to the body. Care and anxiety are dispelled and a general serenity pervades the system. The imagination becomes unusually stimulated, and wit and eloquence frequently flow forth in spontaneous exuberance. Such being the first effects of this kind of excitement, it is not to be wondered at that it has been so universally

coveted by mankind. Go where you will—traverse the globe from pole to pole—and you will not find a people so savage as not to possess some substance capable of yielding this pleasure. It is the solace of the dejected, it imparts confidence to the timid, courage to the coward. Could the effects of alcohol be limited here, we should not have so much to regret in relation to its use.

Other effects now follow of a different character which may be denominated the *second stage.* In the first stage the brain, though powerfully stimulated, retains all its controlling power and the mental faculties though highly exalted, are still under the command of reason. Not so now. The brain gradually loses its power, and a sense of giddiness is felt. The senses become perverted—the vision is disordered—objects change their color and become multiplied—the candles burn blue and the person sees double; volition is now impaired or lost, and all the faculties become irregular in their action. The drunkard imagines a thousand things which have no existence. He is continually mistaking one person for another—is incessantly talking, while his speech becomes thick and noisy. If he attempt now to use his muscles, he finds they have lost their power, and unable to support himself, he falls to the floor. This is the period which, in fashionable language, is called getting *under the table.*

And now comes on the *third stage*, the third scene in this disgusting drama; if consciousness be still retained, everything is confusion and chaos—the blood circulates wildly through the brain—the head throbs and the heart beats violently—strange noises ring through the ears—the faculties, still imperfectly awake, are creative only of wild and monstrous images. Finally all this is overcome by sleep. Such, briefly detailed, are the phenomena attending a fit of intoxication, or rather of poisoning. Now it is very evident that it is not possible for the system to go through all this convulsive excitement without leaving its traces behind it. Accordingly when the patient awakens from his slumber he is in no very enviable condition. The secretions are all shut up—the tongue is furred and dry—there is excessive thirst—the skin is hot and feverish—the mouth foul—the breath offensive—the nervous system is in a state of perfect exhaustion—the eye has lost its fire—the head aches and is giddy—there is sickness at stomach and a degree of dejection and prostration proportioned to the preceding excitement. Nor is this all that is left behind it. A person who has been once intoxicated will probably become so again. Every succeeding fit will increase his desire for the accustomed stimulus, while it undermines and destroys the power of resistance.

Every case of intoxication does not terminate in the way just mentioned. Sometimes apoplexy and death are the results; then the drunkard's deep dreamless sleep "*knows no waking.*"

2. Another of the effects of the immoderate use of alcohol is the production of a peculiar form of disease, which has been called by various

names, but which is generally known under that of *delirium tremens.* The other names given to are *manià a potu, manià e tremulentia, brain fever of drunkenness.* When fully formed this affection consists of a certain degree of mental alienation, accompanied with a tremulous motion of the hands and frequently other parts of the body. More commonly it occurs in persons who have been long accustomed to the intemperate use of liquor, and whose nervous systems, from that and other causes, have become greatly deranged. In some cases, however, it is brought on by a single fit of intoxication, and this I believe is more likely to happen when it has been the result of some mental trouble or affliction. The symptoms which first announce the approach of this affection are those of general derangement of the digestive organs; there is loss of appetite, oppression at stomach, followed by nausea and vomiting. Tremor of the hands and mental aberration now come on. The eye is wild and the whole manner furious and ungovernable, differing, however, very much in different subjects. They now become the prey of diseased sensation and disordered imagination. Generally speaking, fear and suspicion give the hue to all their fancies. In their incoherent wanderings they imagine themselves beset on all sides by knaves or enemies—their business has been ruined, their hopes are blasted, and even their persons are in constant danger. If the patient should fall into a sound sleep, all this will pass off, and he will be restored to the integrity of his faculties. In other cases sleep is unattainable, and then it runs on to a serious termination. The pulse becomes smaller and more rapid—the skin is cold and covered with clammy sweat—subsultus tendinum—coma or convulsions come on, and death closes the scene.

It has been the general opinion that delirium tremens results from the *sudden abandonment* of liquor, after the immoderate use of it. Dr. Armstrong is of this opinion, p. 258. On this subject Dr. Channing states an interesting fact. In the almshouse at Boston, where habitual drunkards were daily admitted, and at once deprived of liquor and kept on a low diet, not a single case of delirium tremens occurred. (New Eng. Jour. v. viii. p. 28.)

3. But intoxication and delirium tremens are not the only effects. From the continued use of alcohol various diseases are produced, functional and organic. That the stomach should be permanently deranged in its functions, from repeated and excessive stimulation, is not to be wondered at. From the law of the system already alluded to, that excitement is followed by collapse, it is a necessary consequence that the tone of the stomach must sooner or later become permanently impaired. Hence it is, that the appetite is lost, and the powers of digestion enfeebled; not merely, however, functional disorder, but actual organic disease takes place. This is also a necessary result of the continued irritation and determination of blood kept up in the stomach. Hence, we have chronic inflammation

of the stomach and scirrhus of the pylorus. Besides the stomach, other organs also suffer eventually from the poisonous influence of the continued use of alcohol. Among these the most prominent is the *liver*. From the repeated congestion to which this is subjected, it eventually becomes fatty, or even scirrhous. Along with this comes *ascites*, from pressure on the portal vessels, and *jaundice*, from obstruction of the gall ducts. The *kidneys*, too, are affected with a peculiar form of disease, which is generally accompanied with albuminous urine. This is the *granular kidney* of Bright.

Not merely the solids suffer, the fluids also become affected. That alcohol is absorbed into the circulation is well established, and that it pervades every part of the system is abundantly proved by the poisonous breath which exhales from the confirmed drunkard.

The *mind* eventually suffers, and permanent mental aberration takes place, showing itself, according to the temperament of the patient, in the ravings of furious mania, or in the stupidity of hypochondriasis. If you wish for information on this subject, you have only to analyse the records of our lunatic asylums, and you will find that a large proportion of the cases of insanity arise from this cause.

TREATMENT OF THE EFFECTS OF EXCESSIVE USE OF ALCOHOL.

INTOXICATION.—This of course resolves itself into two divisions, viz. the management of the fit of intoxication, and the cure of the *habit*. The first is comparatively easy, the second is more difficult.

(*a*.) *Of the Fit.*—As a general rule, the best plan is to let the person sleep it out, and trust to the recuperative powers of nature. In some cases the symptoms are of such a nature as to make it desirable to break in upon the stupor under which the patient is laboring. In these cases the remedy first to be resorted to is *vomiting*. This is to be done with the double view of emptying the stomach, and of making the peculiar impression on the brain and nervous system which we know results from this process. To excite vomiting, copious draughts of warm water or salt and water, or chamomile tea, will answer every purpose. In other cases more powerful articles are required, and then ipecacuanha or the vitriolic emetics may be used. When the insensibility is so profound as to render the patient unable to swallow, the stomach pump may be used.

Next to vomiting, the *bowels* should be unloaded, and the quietest and best mode of doing this, of course, is by means of a stimulating injection. The common enema with a couple of tablespoonfuls of salt will answer every purpose.

Cold applications to the head are also exceedingly advantageous, and ought to be continued for a length of time. This may be done either by

cloths dipped in cold water, or by pouring cold water on the head, as in cases of poisoning by opium. If a person is found drunk in the streets, a very good plan is to have him carried to the next pump, and have cold water poured on his head for about a quarter of an hour. Very generally this brings him to his senses. (See Rush, vol. i. p. 305.)

[This, as I before stated, is a remedy of very great power, and must not be used carelessly. I have known one instance where, used by non-professional persons, it had nearly destroyed life. In old, broken-down drunkards it is full of peril; their system has so little power of resistance that, if the cold dash be carried far, reaction is impossible. Use this remedy, then, but use it carefully.—Ed.]

To increase the degree of cold, rectified spirit of wine and ether have also been recommended as good applications. (Trotter on Drunkenness, p. 196.)

Immersion of the whole body in cold water frequently counteracts the insensibility produced by drunkenness. This happens very frequently at sea. Sailors in a state of intoxication very often fall overboard; when taken up, they are generally sober. Buffon states that "among the savages in the isthmus of America the women throw their drunken husbands into the rivers, in order the more speedily to remove the effects of intoxication." (Trotter, p. 198; see also Rush, vol. i. p. 305.)

With regard to the use of cold in this way, proper discretion must of course be exercised. If the person has already been long in the cold—if he is feeble, pulse small, &c., nothing can be more injurious than this treatment. To sustain the action of cold, and be benefited by it, requires a certain degree of constitutional vigor as well as animal heat. If proper reaction does not take place, it may prove fatal.

When apoplectic symptoms are present, as they not unfrequently are, the propriety of *bloodletting* becomes a question. In the use of this remedy, however, I would advise you to be cautious. Cases may occur in which depletion may be very proper, but, generally speaking, its effects are injurious, and sometimes even fatal; at any rate, bleeding should not be resorted to unless there be present a good deal of constitutional vigor. It is the observation of experience, that persons under the influence of liquor do not sustain well the loss of blood.

Acids have long been celebrated as possessing the power of counteracting the effects of drunkenness. Vinegar has, accordingly, been used in large quantities for this purpose with success. (See Macnish, p. 100.)

(*b.*) *The Cure of the Habit.*—This, I fear, is a task almost hopeless. It depends not upon the physician, but upon the patient himself. He can do it, if he possess sufficient fortitude and decision; but unfortunately the habit of intemperance has already undermined so completely the moral energy, without which nothing can be done, as to render the case almost without a remedy. If moral energy sufficient be still left, the patient

ought to be recommended to break off at once the use of ardent spirits. On this subject I am aware that a difference of opinion exists. By some it is supposed to be dangerous to break off immediately, and it is therefore recommended to be done gradually; and various devices have been suggested for doing this. This is not meeting the enemy fairly. It is compromising and sporting with him; and lamentable experience, I believe, will prove that, in a majority of cases, such a course has proved abortive. In some cases, however, it has proved successful; for example, the celebrated Dr. Pitcairn once cured a Highland chieftain who was a patient of his "by exacting a promise that he would every day drop a certain quantity of sealing-wax into his glass. He did so, and as the wax accumulated the capacity of the glass diminished, and consequently the quantity of whiskey it was capable of containing. By this plan he was cured of his bad habit altogether." (Macnish, p. 163.)

Those who object to the immediate and total abandonment of ardent spirit, do it on the ground that the system may be brought into a state of dangerous collapse, and delirium tremens, &c., induced. This may certainly sometimes be the case, although it does not happen so frequently as is generally supposed. To obviate anything of this kind, a good plan (as recommended by Dr. Rush) is to substitute bitter vegetable infusion, beer, wine, and opium. He says, "by the temporary use of these substitutes for spirits, I have never known the transition to sober habits to be attended with any bad effects, but often with permanent health of body and peace of mind."—Vol. i. p. 314; Macnish, p. 164.

The first thing then to be done is, to endeavor to operate upon the still remaining moral sensibility in such way as may induce the person to make a great effort to break off the habit at once. The means by which this is to be brought about are obviously as different as the peculiarities of natural disposition in different individuals—as their modes of living—occupation—various relations in life, &c., &c. No general rule can be laid down for the physician, except to gain by every means in his power the respect and confidence of the patient, so far as to induce him to listen to his representations. When this is gained he may sometimes address the reason, or the passions, or the fears, in such way as to produce a salutary influence. The first mode, then, of attempting to cure the habit of drunkenness is *addressed to the mind exclusively.*

The second is *addressed to the body*, and the principle upon which it is conducted is to associate with liquor something so unpleasant to the taste, smell, or its general operation on the system, as to give the person a disgust to it. This is the general principle on which all the nostrums for this purpose have been made. In many cases they have succeeded admirably. Dr. Rush says he once cured a negro of his fondness for liquor by putting a few grains of tartar emetic in his rum. He was so sickened by it that he thought he was poisoned. For two years afterwards he could not bear

either the smell or the sight of rum. Generally speaking, the cure in this way is only temporary, unless aided by moral restraints. They are, however, exceedingly beneficial as giving time for reflection, &c.

2. *Treatment of Delirium Tremens.*—On this subject I can only make a few remarks. Although various opinions are entertained in relation to the remedies proper in this curious affection, there can be no general difference in regard to the general principles upon which the management of it ought to be conducted. In this disease there are two leading conditions of the system which require to be attended to. The *digestive organs* are generally more or less deranged, and the *brain and nervous system* in a state of irritation. Our remedies, therefore, ought to be directed mainly to the correction of these two conditions.

With respect to the first, as a general rule, the best remedies that can be resorted to are *purgatives*, and of these the best are calomel, aloes, and a mixture of rhubarb, magnesia, and mint water. By the judicious use of these either separately or conjointly, as the circumstances may require, you will unload the bowels, promote secretion from the liver and intestinal canal, determine from the brain, and in all these ways quiet nervous irritation, besides preparing the system for the subsequent use of other remedies. This, then, is the first thing to be done, and the extent to which it must be carried is to be regulated by the period of the disease and the peculiar symptoms attending it. As a general rule, purging as well as all other evacuating remedies should be limited to the earlier periods of the disease.

Another class of remedies that has been highly recommended for the accomplishing the same object is *emetics*. These were, as before stated, first advised by Dr. Klapp of Philadelphia, in the year 1817, and since then have been approved by many distinguished physicians. The objects to be attained by them are to unload the stomach, to act on the liver and change the secretions from that organ, and by the general shock given to the system to produce a salutary impression on the brain and nervous system generally. If, therefore, the stomach and liver be much deranged, emetics may be valuable remedies. Great care, however, should be taken in the selection of the article used. Tartar emetic is too powerful a sedative, and in many cases has caused fatal prostration. If it be used at all, two things should be attended to:

1. That the patient's strength be not too greatly impaired to bear so active an article.

2. It ought only to be used in the early stage of the disease.

Having in this way corrected the condition of the digestive organs, the next thing to be done is to quiet nervous irritation and produce sleep. This is effected in two ways:

1. By the abstraction of all kinds of stimulants, and letting the patient wear himself out until he falls asleep. Thus, by keeping a patient in a

dark room, so arranged that he cannot injure himself, and leaving him entirely alone, he will frequently, after a while, become exhausted and fall asleep. When sleep is attained the fit passes off and the patient recovers.

2. *Opiates.*—On this subject there is a difference of practice, some giving them in very large doses and repeating till sleep is produced. Others take a moderate course, using opiates occasionally and in smaller doses. As to the merits of these two plans:

1st. If the former succeed, if sleep deep and continued result, the cure is nearly certain, but,

2d. If it fail, the patient is certain to be injured, and very probably may be killed outright. Use it therefore, if at all, with care.

[I have used chloroform with most admirable results in this disease; calm, quiet, and protracted sleep followed its administration, and the patient was entirely rational on waking.—ED.]

Many persons have been led into the use of liquor from the idea that it has a good effect on the mental faculties; and this notion has been sustained by the fact that some men never can exert their minds to make any great effort without the aid of artificial stimulation. In this way I fear many a noble spirit has been wrecked, habits of intemperance having been gradually acquired under the pleasurable excitement of moderate stimulation ending in the total prostration of mind and body.

Now, with regard to this idea of stimulating the mental faculties, let me lay down a few common-sense precautions. Now, first with regard to the imagination:

1. If any man takes liquor to stimulate his imagination, let him first be sure that he has an imagination to stimulate. This imagination is a rare gift, vouchsafed by God to only a few of his creatures. If a man has no imagination he may stimulate till he is tired, without finding corresponding results. He might as well try to draw water from the flinty rock, or strike fire from a potatoe. Remember the old philosophical axiom, *ex nihilo nihil fit.*

2. Even if a man is satisfied he has an imagination he should recollect that liquor only stimulates it to a certain extent; beyond this it only makes the man ridiculous; for the imagination, sublime and soaring as it is, requires to be well balanced.

3. Recollect, if alcohol stimulates the imagination it impairs the judgment and clouds the reasoning faculties. Now, it is not imagination, but judgment and reason, which is required in the grave business of life. In the practice of our own profession, especially, we want no flights of fancy: we want sound judgment and plain common sense; we do not want a man in the clouds, we want him on terra firma, and therefore physicians, above all others, should be careful how they go *ballooning it* in the air. Rely on it their patients will not follow them.

4. Alcohol can only stimulate the faculties, it cannot create them; it

must stimulate a man's faculties, such as they are. If he has mind it may develope that to be sure, but if he is naturally stupid, it will be just as sure to develope his stupidity. It can do nothing more. There is an old maxim, *in vino veritas*, which is generally translated to mean, that under the influence of wine a man speaks the truth; but it means a great deal more. Its true meaning is, that under the influence of wine a man's *true character* is developed. That is the maxim. Wine acts like nitrous oxide gas. Hence it is that when a knave wants to take advantage of another man and find out his true character, he tries to get him under the influence of liquor. Let a man, therefore, beware how he suffers himself to be duped in this way. The truth is, gentlemen, the less a man in health has to do with alcohol the better. To the young this is peculiarly applicable. Their blood courses rapidly enough in their veins already without any stimulation. In the ordinary business of life the great thing is to keep cool and collected, and when great enterprises are to be undertaken let the enterprise—let the occasion be the stimulus. Do you think Napoleon or Wellington needed any other stimulus than the great stake for which they were contending at the battle of Waterloo? Look even at the picture, disgraceful in some respects, but instructive in others, presented by the recent pugilistic combat in our country. Read the account of the training which Tom Hyer and Yankee Sullivan underwent, and see if liquor was one of the aids to which they resorted? I make these remarks, gentlemen, not so much for yourselves, but for the sake of the patients. Judicious advice, cautiously given, has saved many a man from ruin.

AQUA AMMONIA.—Aqua ammonia is water holding in solution ammoniacal gas. Water is capable of holding a third of its weight of gas, or 430 times its volume, and increases in bulk about two thirds.—U. S. Disp., p. 763. The aqua ammonia of the shops, however, does not contain this proportion, and it varies according to the mode of preparing it.

Properties.—Aqua ammonia is a colorless liquid, with a caustic alkaline taste, and a pungent odor. Turmeric paper when held over its fumes is turned to reddish brown. It is lighter than water, and its strength varies with its specific gravity. It readily attracts carbonic acid from the atmosphere if not kept in tight bottles. It unites with oils and forms liquid soaps or liniments. Sp. gr. varies from 880 (aq. ammon fortiss) to 960.

Effects.—In its local action aqua ammonia is irritant, whatever be the part to which it is applied, the degree of irritation varying with the strength. When applied to the skin, if of any strength, it causes redness, heat, pain, and eventually actual vesication. If held under the nostrils, its fumes produce irritation of the mucous membrane of the eye, of the nostrils, and if inhaled a similar effect is produced upon the air passages.

Taken into the stomach in small quantities, it produces a slight sense of warmth in the mouth, throat, and epigastric region. In large quantities it acts as an irritant poison. In its remote action it produces the effects of a stimulant; the pulse is rendered fuller and more frequent; the muscular and nervous power of the system is augmented; the heat of the surface is increased, while a tendency to perspiration is induced.

From this combination of properties it is an article of great value, and may be used with advantage in many cases where a prompt and efficient stimulant is required. From the tendency which it has to act on the skin, it may, as well as the carbonate, be used frequently in febrile affections at a much earlier period than many other stimulants.

Mode of Administration.—From five to ten drops may be given in a cup of cold water or milk, and repeated every two or three hours, or oftener, as it is very evanescent in its operation.

Ammonia has been given, and in a few cases with success, to cure the bite of venomous snakes.

Carbonate of Ammonia.—This salt is prepared by triturating muriate of ammonia and carbonate of lime together, and then subliming from a retort into a cold receiver.

Properties.—When recently prepared it is in colorless, translucent masses, about two inches thick, moderately hard, and of a striated and crystalline appearance. Its smell is pungent, and its taste sharp and penetrating. "Turmeric paper when held over it is turned of a reddish brown color by the ammonia, which escapes." (Phillips, p. 40.)—It is soluble in four times its weight of cold water. By boiling water or alcohol it is decomposed with effervescence. When exposed to the atmosphere it gradually loses its smell and becomes opaque and friable, and is converted into the bicarbonate.

Effects on the System.—Carbonate of ammonia is a local as well as a general excitant. Smelling and inhaling its vapor cause irritation of the mucous membrane of the nose, larynx, and trachea. When swallowed in moderate doses, it produces no obvious local effects; in larger doses it proves emetic, and in still larger doses it causes irritation, pain, and sometimes actual inflammation in the stomach. In its remote action on the system it increases the force and frequency of the pulse, and operates on the skin as a diaphoretic.

[It is *the stimulant* for extreme prostration after uterine hemorrhage; of the many valuable practical hints for which I am indebted to my *old master*, the late Dr. Joseph Parrish of Philadelphia, no one has been of more value to me than his emphatic "Pour down the volatile alkali as fast as she can swallow it," in a case of tremendous uterine hemorrhage.

"Peace to the good man's memory; let it grow
Greener with years, and flourish in the lapse of ages."—Ed.]

Mode of Administration.—The best forms of giving this article are in pill or in solution. From its volatile nature it should never be given in powder. The pill may be made with some vegetable extract, and should be kept in a tight bottle. The dose is from five to ten grains every two or three hours.

As an emetic it is used sometimes in paralysis—dose grs. xxx.

CAMPHOR.—This is a substance found in a great number of vegetables, such as *peppermint*, *sage*, *thyme*, &c., from which it is obtained by distillation. The camphor of medicine, however, is obtained from the *Laurus camphora*, a large tree,* which is a native of China and Japan. The camphor is obtained from the leaves and twigs, which are first steeped and boiled in water, from which it is sublimed. In this state it is the *coarse camphor* imported into Europe, where it is afterwards purified by resublimation.

Another kind of camphor is obtained from the *Dryobalanops Camphora*, a tree of great size growing in the forests of Sumatra. In this tree the camphor exists in concrete masses of considerable size in the trunk of the tree, from which it is obtained by splitting it. By the Chinese this is considered as superior to the other, but it is not exported to Europe.

Camphor was unknown to the Greek and Roman physicians, and we are indebted for our first knowledge of it to the Arabians. With the Chinese physicians it is a favorite remedy, and is much used by them.

Camphor is a concrete substance, of a white color, semi-transparent, and capable of assuming a crystalline form; it is tenacious and somewhat unctuous to the touch; though brittle, it is somewhat ductile, and therefore not easily pulverized; smell penetrating and fragrant; taste bitter and pungent; lighter than water, its specific gravity being only 0·9887. It is very volatile, and in warm weather evaporates in very large proportions by simple exposure to the air. It is highly inflammable; burns with a brilliant flame and much smoke, but does not blacken, and leaves no residue.

In *water* very sparingly soluble, an ounce dissolving not more than half a grain. It imparts, however, both its odor and taste to water, and may be suspended in it in large quantity, by means of mucilage, sugar, yolk of eggs. In alcohol, ether, and the oils, both essential and expressed, it is soluble. *Sulphuric* and *nitric acids* dissolve it, but it is again separated by the addition of water. Its most powerful solvent is strong acetic acid. The alkalies have no effect upon it. With the hardest resinous substances it unites, and converts them into a soft tenacious mass. By distillation

* Mr. Abeel saw a tree twenty feet in circumference, fifty feet high, and having branches nine feet in circumference.

with nitric acid it forms camphoric acid. It is composed of 1 eq. camphagin (C. 20 H. 14) and two of water.

Effects.—Various opinions are entertained in relation to the effects of this article. Some consider it a stimulant, others a sedative. Dr. Cullen maintains the latter, and in his Materia Medica you will find a good deal about it.

When given in moderate doses, the first effect is to produce slight exhilaration, and to increase somewhat the heat and strength; after this it quiets irritation, allays spasm, and causes a tendency to sleep. When given in large doses it causes great anxiety—vertigo, tremors, coldness of skin, convulsions, and death.

From its effects on the nervous system, it has been used by some as an habitual stimulant like alcohol or opium. A case is related of a female who, from "the casual application of camphor as a remedy for toothache, contracted a fondness for it so fascinating and irresistible that she at length consumed it in large quantities, and could not be induced to relinquish it by all the remonstrances of her friends, or her own conviction of its pernicious consequences."

[I have known a similar case.—Ed.]

Camphor is a special stimulant of the genito-urinary apparatus; in moderate doses augmenting the energy of these functions, causing voluptuous dreams, erections, &c., also ardor urinæ. Gouch thought it especially useful in controlling uterine irritation, dysmenorrhœa, irritable uterus, &c. It is often used in typhus, and by some supposed to have great power in controlling subsultus tendinum. It is very useful in hysteria and the kindred affections as a calmant. It is much employed in certain forms of melancholia to relieve despondency, cause mental quiet, and produce sleep. Especially is this true when the mental disease has any connexion with the sexual organs, as puerperal mania, nymphomania.

Externally camphor is very extensively employed in solutions, both in oil and alcohol, in sprains, chronic rheumatism, indolent enlargement of the glands, &c.

Mode of Administration.—Camphor is given in pill in dose from five to twenty grains; also in emulsion, made by rubbing it up with sugar, gum arabic, and water. Its suspension is rendered more complete by adding a little myrrh.—U. S. Disp.

Phosphorus.—This simple substance was first discovered in human urine in the year 1699 by Brandt, an alchemist of Hamburgh. In 1769 a Swedish chemist, by the name of Gahn, discovered it in bones, in which it exists in combination with oxygen and lime, forming the phosphate of lime. In various combinations it is found in the animal, vegetable, and mineral kingdoms. There are various modes of obtaining it: by taking

phosphoric acid (which is procured by decomposing bones by sulphuric acid) and mixing it with charcoal, and then distilling in an earthen retort. As soon as the retort acquires a red heat, a substance of a reddish color comes over, having very much the appearance of wax. This is received into water. During this process the phosphoric acid is decomposed; the oxygen uniting with the charcoal, while the phosphorus is volatilized.

Properties.—Phosphorus is a semi-transparent solid, of a yellowish color and a waxy appearance; and it is without taste, and has a garlic smell. In consequence of its great inflammability, it requires to be kept under water. In water it is insoluble; in alcohol and the oils it is soluble, and in ether much more so.

Effects on the System.—Of all the stimulants, phosphorus is one of the most prompt and energetic. Taken in moderate doses it produces a sense of warmth in the stomach, together with a very powerful general excitement, quickens the circulation, increases the energy of the nervous and muscular systems, augments the animal heat, promoting at the same time all the secretions, especially those of the skin and kidneys, and exciting the venereal appetite. In larger doses it causes uneasiness and burning in the stomach, together with general feverishness of the system. In still larger doses it produces all the effects of a virulent corrosive poison.

In the use of this article the greatest caution should be exercised. Even very small doses have in some instances terminated life.

Mode of Administration.—The form in which this medicine is prescribed is a matter of great importance. In substance it should never be given, inasmuch as it frequently acts as a mere caustic, producing violent inflammation of the stomach and bowels.

The best forms in which it can be given are in solution, either of *sulphuric ether* or *some fixed oil.* To prepare the first, eight grains of phosphorus are dissolved in one ounce of sulphuric ether. The addition of a small quantity of the essential oil of cloves, according to Lobstein, renders it still more uniform and safe in its action. Of this preparation four or five drops may be given two or three times a day, either on sugar or some spirituous tincture. In this way about one sixteenth of a grain is taken at a dose.

An objection has been urged to this preparation on the ground that when introduced into the stomach the heat of that organ may cause the ether to evaporate and leave the phosphorus in a separate state, and thus cause irritation and inflammation of that organ. A solution of phosphorus in fixed oil, is therefore, preferred. This is prepared by putting one ounce of phosphorus, cut into very small pieces, into a flask with a ground stopper, and adding sixteen ounces of oil of olives or almond oil; let this digest in a dark place for fifteen days, then decant, and render it aromatic by the addition of a few drops of the essential oil of bergamot. After

being prepared, it should be kept in a well stopped bottle, excluded from the light. From twenty-five to thirty drops of this may be given in the twenty-four hours, in some mucilaginous vehicle, and may be continued for four or five days.—(Magendie's Formulary.)

NERVINES.

By this class of agents I mean those which are usually denominated *Antispasmodics*, and may be considered as stimulants acting specially on the nervous system. The term antispasmodic, as designating a class of medicines, is objectionable on a variety of accounts. In the first place, it is not at all descriptive of the effects of these agents on the living system, but views them simply as correcting a single morbid condition of that system. In the second place, spasm arises from such a variety of causes that the term antispasmodic is equally applicable to as great a variety of agents, all differing from one another in their effects on the system. In fact, it has led to the empirical use of them by supposing them capable of controlling spasms.

By nervines are meant a class of agents which produce a stimulant impression on the nerves, without being followed by the insensibility which attends the operation of narcotics.

EFFECTS ON THE SYSTEM.

Most of the agents of this class are remarkable for their peculiar smell and volatility. In consequence of this their mere odor produces a certain effect on the system. When taken internally in moderate doses they stimulate the nerves of the stomach and intestines. The local impression thus made is not equally manifest in all cases. In some a sense of heat and excitement is produced in the stomach; in others a tonic and cordial sensation only; while in others again little or no sensible effect is occasioned.

The impression is speedily diffused to other parts of the system. The whole nervous system is more or less impressed. The vascular system is excited, and the pulse become more frequent and fuller. These effects, however, are not invariable.

The bowels are differently affected; while in some cases they are moderately relaxed, in others no effect is produced on them. As already stated, these agents do not produce any of the stupor and insensibility which characterize narcotics. Some of them are supposed to induce a tendency to sleep, but they do this only so far as they relieve the system from pain and other morbid symptoms for which they may be prescribed.

Most of the articles of this class are absorbed into the circulation, and their odor can be recognised in the various secretions.

With regard to the effects of this class of agents there are two or three peculiarities worthy of notice, viz. 1. They are all produced very quickly. In this respect they differ from a great proportion of other medicinal agents. 2. They are very transient, and therefore to keep up a certain effect they require to be repeated at short intervals.

There is no class of agents whose purity is of more importance than the one we are considering. Unless they are pure and good little or no effect is produced by them, and it is from this cause no doubt that so much of the discrepancy in relation to their effects has arisen. There are various ways in which the quality of these articles may be changed. In the first place by long keeping they lose their odor, and with this much of their active power. In the second place, by actual adulteration. This is especially the case with such articles as musk and castor, the price of which is very high, and therefore the temptation to adulterate proportionably great.

From the stimulant operation of these agents they are contra-indicated in all cases in which there is great plethora or inflammatory action present. As a general rule, too, they ought never to be prescribed until after the bowels have been properly evacuated. It is only after due preparation of the system that these can be used with advantage—and if thus used they will do much more than might otherwise be expected.

DISEASES IN WHICH NERVINES ARE APPLICABLE.

Nervines acting as stimulants to the nervous system are used mainly for the purpose of exciting that system and controlling spasm. They are accordingly given in diseases characterized by impaired nervous energy and spasm.

1. A CONDITION OF THE SYSTEM CHARACTERIZED BY IMPAIRED NERVOUS ENERGY.—This may be induced by whatever has a tendency to debilitate and exhaust. Profuse evacuations of various kinds, and the debility of protracted disease, are the most common causes of it. Although in most cases of this kind a judicious course of ordinary tonic treatment is the most efficient that can be adopted, yet advantage may frequently be derived from the specific action of some of the agents of this class. In the nervous debility which succeeds disease, valerian sometimes operates admirably in steadying the nerves. In the advanced periods of fever musk is a stimulant which is frequently advantageous. By Dr. Graves it is highly recommended in those cases in which congestion of the brain is apprehended and yet a stimulant is required.

2. Spasmodic Diseases.—These are the diseases in which this class of agents are specially recommended. A very little acquaintance with their history will, however, show that in a large majority of cases they have done but little good, and indeed it is not to be expected that they should. Spasm is a morbid condition, depending upon such a variety of causes, and accompanied with such different and even opposite states of the system, that it is impossible any one set of remedies should have a specific control over it. And yet antispasmodics have in fact been invested with this power. That they should have disappointed such expectations is by no means wonderful. Let us briefly review some of these diseases.

Epilepsy.—The causes which produce this curious disease are various. They may be advantageously divided into those which act immediately on the brain and those which act primarily on some other parts of the system and secondarily on the brain. Under the first may be ranged various mechanical causes producing pressure on the brain, such as malformation of the cranium, injuries of the same, depression of bone, tumors, etc., an overloaded state of the vessels and effusions in the brain, strong mental emotions. Under the second may be arranged intestinal irritations of various kinds, more especially the irritation caused by worms, biliary concretions, calculi in the kidneys and bladder, acrid substances introduced into the stomach, the suppression of accustomed evacuations, and the like.* In the condition of the system, too, there is a wide difference. While in some cases it is plethoric, in others it is marked by general debility.† Now it is evident that arising from such various and opposite causes the same mode of treatment cannot be uniformly applicable. It is idle to suppose that any set of remedies possess a specific power of controlling epileptic spasm or convulsion. Experience has abundantly confirmed the truth of this. The general management of the disease divides itself into that which is required during the paroxysm and that during the intervals. During the first little, if anything, can be done with much effect, and the great object is during the intervals to endeavor to correct the condition of the system upon which the recurrence of the paroxysms appears to depend. If the disease is connected with an overloaded state of the blood-vessels, venesection and evacuants are to be resorted to. If it depend upon intestinal irritation, emetics, cathartics, anthelmintics, etc., will be required, according to the nature of the cause of the intestinal trouble. If general debility and irritability be present, tonics will be the appropriate remedies. By pursuing this course of management, viz. by removing the cause of the disease and correcting the existing condition of the system, much may, in general be done to eradicate it. With regard to the use of antispasmodics, the result of experience has demonstrated that little reliance can be placed on

* See Cooke on Nervous Diseases, pp. 350–5. † Ibid. v. i. p. 374.

them. The only one that has had much reputation is Valerian. Of these the older writers speak in the highest terms. Tissot says, if epilepsy resist Valerian *it must be incurable!!*

Alibert, on the other hand, says that he tried it for six years in the Hospital of St. Louis and always without success. It is said, however, that he used the *infusion*, which is almost inert.* Still Valerian is very far from being a specific. In many cases it may prove serviceable by its stimulant operation on the nervous system, while in others it is inefficacious. In young subjects, where the disease is recent, and where it is not connected with any organic difficulty, this remedy may do good.† In using it, however, special regard should be had to the condition of the system. As it is stimulating in its action, it should be used with great caution where plethora or local determination exist. To obtain its best effect, too, it should be used in full doses and the article should be good.‡

Chorea.—This is a disease in which we might suppose the agents commonly called antispasmodics could be used with advantage, and experience has proved that as auxiliaries they may frequently be very valuable. As general remedies calculated to control spasms, however, they are very ineffectual. Like epilepsy, chorea arises from various causes and is associated with different states of the system. It is impossible, therefore, that any one mode of treatment or any particular set of remedies can answer in all cases Under different circumstances bloodletting, purgatives, tonics, revulsives, etc., are all useful remedies, and so are antispasmodics. In cases marked by fulness of habit or an inflammatory diathesis, they are always improper. On the other hand where this is not the case and where the temperament is highly nervous and excitable, they may frequently be used with advantage in conjunction with other agents. By Copland, after the preliminary exhibition of purgatives and the use of suitable depletion, Valerian is highly recommended in connection with tonics.§ Eberle has found assafœtida, in combination with quinine, successful after due evacuations. Pills containing one gr. of sulphate of quinine and two grs. of assafœtida were given every four hours.‖ In chorea coming on about the age of puberty in females assafœtida has been specially recommended. [Eber. M. M. v. ii. p. 135.]

Hysteria.—There is no disease in which the power of antispasmodics is more strikingly shown than in this. Even here, however, they are not to be looked upon as specifics. Hysteria, like all spasmodic affections,

* Dict. Mat. Med., vol. vi. p. 833. † Ibid. p. 374.

‡ Dictionary, Art. Chorea. § See Cooke on Nervous Diseases, p. 350–5.

‖ Practice, vol. ii. p. 82.

depends upon various conditions of the system, and the treatment must be directed accordingly. During the convulsion, according to the state of the patient, bleeding, emetics, enemata, &c., are among the remedies first to be employed, with the view of removing the cause which may produce it. Among the agents proper, after this, to act specifically on the nervous system, some of the antispasmodics, in combination with opium, may be employed. Of these ether and assafœtida are among the best. Ether is very prompt in its action, and in combination with laudanum, is efficient in controlling spasm. The tincture of assafœtida and laudanum also acts very well.* Where it is difficult to get anything into the stomach, the same may be accomplished by an enema. For this purpose, from a scruple to half a drachm of assafœtida may be rubbed up with half a pint of water, with the addition of a drachm of laudanum, and this injected into the rectum.

In chronic hysteria, independent of convulsion, in which the whole nervous system appears to be in a deranged condition, some of the agents of this class are the remedies resorted to, and at the head of the list is assafœtida. It acts with more power and efficiency than any other agent.† Besides stimulating the nerves, assafœtida is useful in these cases by proving laxative. In some cases sulphuric ether and laudanum, in doses of ten drops of laudanum and twenty of ether, repeated every two hours, answers a good purpose.‡ Valerian, too, frequently proves beneficial, and particularly in cases where a tonic to the digestive organs is required;§ the tincture is the best preparation. Castor, too, in some cases proves salutary‖—so has the skunk cabbage. Dr. Thacher states that in a case of violent hysteria, in which musk and other antispasmodics had failed, two teaspoonesfuls of the powdered root in spirit and water afforded immediate relief.¶ Eberle states that he has given this frequently in chronic hysteria, and with advantage. He gave a wine-glass of the infusion (℥ j of the root to a pint of water) every four or five hours.**

After all, however, antispasmodics are mere auxiliaries, and more may be done in the intervals by tonics and other remedies calculated to correct the general condition of the system.††

Spasmodic Asthma.—In this complaint antispasmodics have been extensively used, and in some cases with benefit. The simple inhalation of the vapor of ether frequently proves exceedingly beneficial; assafœtida has also been given with advantage. Of the simple antispasmodics, however, the skunk cabbage is the most efficacious. This remedy was first recommended by the Rev. Dr. Cutler, by whom it was frequently found successful

* Eberle's Prac., vol. ii. p. 106.
† Home, p. 200.
‡ Eberle's Prac., vol. ii. p. 108.
§ Eberle's Ther., vol. ii. 151, specially.
‖ Eberle's Practice, vol. ii. p. 111.
¶ Barton, vol. i. p. 131.
** Practice, v. ii. p. 110.
†† Thomson, vol. i. p. 627.

when all others had failed. From thirty to forty grains of the dried pulverized root were given every two or three hours during the paroxysm, according to the urgency of the symptoms. After the paroxysm has subsided, the use of the remedy is to be persevered in for some days. This mode of treatment is said to have been obtained from the Indians, who repeat the dose for several mornings after the paroxysm has passed off.* By others this remedy has been tried, and with beneficial results.

The antispasmodic, however, which answers better in this disease than any other, is the lobelia inflata. This has already been noticed under the head of emetics. As there stated, it combines the action of an emetic and antispasmodic. I have used this at the New York Hospital with success in a case in which all other remedies failed.

Colic.—This is a disease which arises from various causes, and is connected with varying conditions of the digestive organs. The treatment must of course vary according to the severity of the case—bloodletting, evacuants, warm bath, opium, and the like, are the remedies to be depended upon. As to antispasmodics, they can only be useful under certain circumstances. In the milder forms of it, and where it arises merely from disordered functions and flatulency, they are frequently of great service. In this way, as gentle stimulants they may be used with advantage in gastrodynia and dyspepsia. In these assafœtida frequently proves a valuable remedy.—(*Eberle, M. M.*, p. 134.)

Where anything like active irritation or inflammation is present, these ought to be abstained from.

In the griping to which children are subject connected with a disordered state of the bowels, assafœtida sometimes proves exceedingly beneficial.—See Dewees.

INDIVIDUAL NERVINES.

Musk.—This is an animal product. It is obtained from the *Moschus moschiferus*, an animal inhabiting the mountains of Eastern Asia, and dwelling on the highest of the snowy peaks. It resembles the deer a good deal in appearance, and is seldom longer than three feet. On the belly of this animal, between the umbilicus and the prepuce, is a bag covered with hair, of an oval shape, which contains the musk. It is about three inches long and two broad, and is found only in the males. Internally it is lined with a smooth membrane having irregular folds in it. It is this membrane which is supposed to secrete the musk. In the young animal there is no musk found; it exists only in the adult. The quantity which

* Barton, vol. i. p. 131. Dyckman, p. 395. Eberle's Practice, vol. ii. p. 218.

the sac contains is from one to two or three drachms. By rubbing against the rocks the animal frequently expresses a part of the musk, and this is said to be the purest kind. Generally, however, the musk is obtained by cutting away the bag, and this is usually done while the animal is still alive. A small hollow reed is inserted into the bag for the purpose of admitting air, and it is then suffered to dry. It is in this state that the musk is imported from China.

Physical Properties.—Musk in the living animal is a viscid secretion. When dried, it is converted into friable, solid grains. They are unctuous to the touch and of a reddish brown color, resembling a good deal dry coagulated blood. Its taste is bitter and disagreeable, and its odor is powerful and peculiar—exceedingly diffusible and permanent. In combination with other perfumes, it is said to possess the property of increasing their odor without imparting its own.

Varieties of Musk.—There are two kinds of musk brought to the market, both coming in bags convex and hairy on one side and flat and destitute of hair on the other. 1. The *Chinese* or *Tonquin* musk. This comes from Tonquin, and is brought from China. The sacs are smaller and rounder than the other variety, and the hair which covers them is of a red color. 2. The *Russian*, called also the *Kabardine* musk, comes from Siberia, and is imported through Russia. In this the sacs are larger and longer, and covered with a coarse white hair.

The best mode of purchasing the musk is in the bag.

Chemical Composition and Properties.—According to the analysis of Guibourt and Blondeau, musk contains the following constituents, viz. water, ammonia, stearine, elaine, cholesterine, an acid oil combined with ammonia, a volatile oil, hydrochlorates of ammonia, potash, and lime, an undecided acid, partly saturated with the same bases, gelatine, albumen, fibrine, a highly carbonized matter soluble in water, a soluble calcareous salt with a combustible acid, carbonate of lime, phosphate of lime, hair, and sand. [Guibourt, vol. ii. p. 744.]

Musk is soluble in water; boiling water taking up about 80 parts in 100. Alcohol dissolves about 50 parts in 100. Ether takes up nearly the whole. [Thompson, p. 610.]

Effects on the System.—When taken internally musk produces unpleasant effects on the stomach, producing eructations with sense of weight, dryness of the fauces, vertigo, oppression of the brain, headache, followed with disposition to sleep. Large doses induce faintness, vertigo, trembling of the limbs, pulse more frequent and fuller. [Pereira.]

Therapeutic Effects.—Musk being an excitant to the nervous system, is proper where such an agent is desired. It is used in low fevers, in spasmodic affections unaccompanied with cerebral fulness.

Dose.—From 10 to 20 grs. either in bolus or emulsion. The tincture is a bad form.

VALERIAN.—The tree which yields this is the *Valeriana officinalis*, a plant indigenous in England and on the continent of Europe. It grows to the height of from two to five feet and is found in low damp situations and on dry and elevated grounds. The part used in medicine is the root, which consists of slender twisted fibres, coming off from a tuberous head. The proper period for digging up the roots is in the autumn when the leaves decay, or in the spring before the flowers expand. They should then be kept in a dry place. The best comes from England.

Physical Properties.—The root of Valerian is of a yellowish brown color externally and white internally. When fresh it has scarcely any smell, but on drying acquires a strong fœtid odor. Its taste is first sweetish, but afterwards bitter and aromatic.

Effects and Uses.—These were referred to when speaking of antispasmodics generally. As a stimulating antispasmodic it is relied on by many in hysteria, and will sometimes remove milder forms of epilepsy. It is an excellent remedy in hemicrania where the state of the system will admit of a stimulant.

Mode of Administration.—Valerian is used in powder, infusion, and tincture. The powder is apt to disagree with the stomach—the infusion is of uncertain strength. The best form is tincture. The ammoniated tincture is a very valuable antispasmodic.

Dose.—Powder ʒi. Tincture ℥ss.

ASSAFŒTIDA.—The plant which yields this drug is the *Ferula assafœtida*. It grows native in the south of Persia, with a stem about nine feet high and seven or eight inches in circumference at the base. The *root* is perennial, and when fully grown is as large as a man's leg. It contains a large quantity of a fœtid milky juice, which is the substance used in medicine. The mode of obtaining it is the following: When the root is four years old (until which time it is not fit to yield it), at the season when the stem begins to wither, this is torn off from the root, which is then exposed by digging away the earth that surrounds it. In this state it is left screened from the sun for forty days. The top of the root is then cut off transversely, and after forty-eight hours the juice which has exuded is scraped off. Another slice is then cut off, and this operation is repeated until all the juice is exhausted, when the root dies. This process occupies about six weeks, and during this time the root is protected from the sun's rays. The juice thus collected is then put together and dried, and this is the assafœtida used in medicine. It comes to this country either from India or by the way of Great Britain in bags or cases containing from one to two hundred or more pounds. [U. S. Disp.]

Physical Properties.—Assafœtida, as imported, comes in large irregular masses adhering together, externally of a brownish yellow color, and interspersed with tears of a white, red, or violet blue. When broken it

presents a variegated, shining surface of a whitish color, which, on exposure, changes to a reddish brown. Sometimes, but rarely, the assafœtida comes in separate tears. The odor is fœtid and resembles that of garlic, and its taste sharp, acrid, and bitter. The best kind is that which is clear in its appearance and of a pale reddish color, and contains a great number of the whitish tears, and has the peculiar odor very strong. By long keeping and exposure to the air it becomes hard and brittle, and at the same time loses much of its odor and somewhat of its taste. Even when dry, assafœtida is pulverized with difficulty.

Chemical Composition and Properties.—According to the analysis of Pelletier, assafœtida contains in 100 parts, resin 65; gum, 19·44; bassorine, 11·66; volatile oil, 3·60; supermalate of lime, 0·30.—(Guibourt.) It belongs therefore to the class of gum resins. It is soluble in alcohol, forming a clear solution, which becomes milky on the addition of water. Triturated with water it forms a milky opaque mixture, from which the resin is gradually deposited, unless yolk of egg or mucilage be added.

Effects and Use.—This is one of the most valuable and most reliable of the antispasmodics, and from its action on the bowels will often produce the best effects in hysteria and other kindred affections. Its effects on the bronchial secretion have already been noted. (See Expectorants.) It also stimulates the uterus, and perhaps the whole genital apparatus, in the male as well as the female.

SKUNK CABBAGE.—This is known by various names, such as the *Dracontium fœtida, Ictodes fœtidus, Symplocarpus fœtida.* This singular plant is indigenous in this country, and is found growing in wet woods, swamps, and on the margins of brooks and rivulets. It flowers about the end of April or the beginning of May. The root is the part used in medicine. The proper period for collecting it is early in the spring or in the autumn. It should be carefully dried for use.

Physical Properties.—The root of this plant consists of a thick body, with numerous radicles attached to it. The body is about two or three inches long and about one inch thick. The radicles are about the thickness of a common quill. Externally the root is covered with a brownish epidermis; internally it is white and amylaceous. When fresh the root has a peculiarly fœtid odor. This is supposed to depend upon the presence of a volatile oil, which is dissipated by heat and exposure. Its taste is acrid, but it loses this by long keeping. As the virtues of this article depend upon its sensible properties, it is evident that they become impaired by keeping. The recently dried root should therefore always be preferred.

Chemical Properties.—"It seems to contain a volatile acrid principle, readily dissipated by heat; a resinous substance, and a gummy or mucila-

ginous principle. The seeds contain a considerable quantity of fixed oil."—*Edwards's Manual*, p. 308.

Effects.—This article, if given in moderate doses, proves stimulant and antispasmodic. In large doses it causes nausea and vomiting, and powerfully affects the nervous system, producing sometimes headache, vertigo, and impaired vision. It was originally introduced into practice by the Rev. Dr. Cutler, by whom it was highly recommended in asthma. It has been used with occasional success in hysteria, chronic catarrh, pertussis, and chronic rheumatism.

Mode of Administration.—The best form is that of powder in doses of from 10 to 20 or 30 grains. As the volatile oil is more apt to be dissipated when in powder, it should never be pulverized until required for use.

Cajeput Oil.—This oil was formerly supposed to be the product of the *Melaleuca leucodendron*. The tree which yields it is now, however, found to be a different species, and is called the *Melaleuca cajeputi*, a small and beautiful tree, growing native in the Molucca Islands. The oil is contained in the leaves, and is obtained from them by distillation. From the small quantity which the leaves contain the oil bears a high price. It is brought from the East Indies in glass bottles.—U. S. Disp.

Properties.—This oil is of a beautiful greenish color, transparent, and very fluid; its taste is pungent and aromatic, and its odor is penetrating, and resembles that of a mixture of camphor and turpentine. It is lighter than water, exceedingly volatile, and burns without leaving any residue. When dropped in water, it diffuses itself over the surface and rapidly evaporates. In alcohol it dissolves very readily.

Adulterations.—From the high price of this article, every temptation is held out for its adulteration, and this accordingly is frequently done. The articles principally used for this purpose are the oil of turpentine, the oil of rosemary, camphor, &c. Its purity is ascertained by some of its properties already mentioned.

1. Drop some of it on the surface of water, and if it be pure it will diffuse itself rapidly over it, and evaporate completely.

2. It burns rapidly when ignited without any residue.—3. It dissolves entirely in alcohol, which is not the case when sophisticated with turpentine.

Effects.—When taken internally, cajeput oil acts as a local and general excitant. It produces a sense of warmth in the stomach, and speedily extends its influence to the rest of the system; the pulse is increased in force and frequency, blood determined to the surface, and perspiration induced. Its use, therefore, is principally in those cases in which it is desirable by means of an excitant to equalize the circulation, and to determine to the surface.

Dose.—The dose is from two to six drops well rubbed up with sugar. Applied externally, it forms a good stimulating embrocation in cases of rheumatism—one part of cajeput oil diluted with four parts of olive oil. —(Thompson, vol. i. p. 185.)

Strychnos Nux Vomica.—This is the Vomica Nut. It is obtained from a tree growing in the island of Ceylon, on the coast of Coromandel, in Malabar, and various parts of the East Indies. It is of a middling size, with a crooked and thick trunk. This tree yields a round fruit about the size of an orange, covered with a smooth, hard rind of a beautiful golden yellow color, and filled with a soft, jelly-like bitter pulp. In this pulp are imbedded a number of seeds, generally from three to five. These are the vomica nuts of medicine and commerce. They are round and flat, with a depression in the centre, resembling somewhat in shape the button of a coat. They are from half an inch to three quarters of an inch in diameter, and about a quarter of an inch in thickness, of a yellowish grey color when good (when inferior they are black); their taste is bitter and acrid; but they have no smell.

Chemical Properties.—Besides several other less important ingredients, the vomica nut has been ascertained to contain the three following principles, upon which its active properties are supposed entirely to depend.

1. *Strychnine*, a peculiar alkaline principle.
2. *Brucine*, another alkaline principle.
3. *Igasuric acid*, so called from the Malay name of the bean of St. Ignatius. This acid, since named Strychnic, exists in combinaiton with both of the alkaline substances just mentioned, forming *Igasurates* or Strychnates.

Effects on the System.—The effects of this article on the system are decided and peculiar. According to the experiments of Magendie, it appears to be established that the nux vomica possesses the singular property of *exciting the spinal marrow and the nerves issuing from it, as well as the muscles supplied by the nerves*, without at the same time affecting the functions of the brain, except indirectly. Hence, when given in suitable quantities, it produces spasms of the muscular system precisely similar to those of tetanus, the muscles becoming sometimes rigidly fixed, while at others there are violent states of spasm alternating with fits of relaxation. On the digestive organs it acts as a tonic, and accordingly it will be found that during its use in moderate doses the appetite is generally improved, at the same time the evacuations from the bowels are rendered less frequent. "In general the superior extremities are bent, and the inferior ones extended. The intellectual faculties are not disturbed, but there is sometimes present a sort of intoxication. Sometimes the urinary and genital organs are irritated. When the dose is a little too large, there comes on difficulty of respiration, swallowing, speaking, and urinating, general

agitation and sweat, but all this is ordinarily unattended with danger."—*Bayle*, vol. ii. p. 241.

These, then, may be considered as the effects of this agent on the system when used in suitable doses, viz.—a tonic to the digestive organs, and an excitant to the spinal marrow and its dependent nerves and muscles. To produce these effects, it is requisite to give it in suitable doses, and continue it for a certain length of time.

Modifying Circumstances. 1. *Dose.*—This modifies very greatly the effect of this agent. When given in very small quantities no sensible effect is caused. When given in moderate medicinal doses, it produces twitching, pricking, and slight spasms of the limbs; if the quantity be still further increased, decided tetanic spasms are brought on, proportioned to the quantity which may have been taken, and the length of time its use may have been continued. Finally, if it be given in still larger doses, it acts as a decided poison. For the purpose of ascertaining the mode in which death takes place, numerous experiments have been made upon animals. "Half a drachm of the powder killed a dog in forty-five minutes, and a grain and a half of the alcoholic extract thrust into a wound killed another in seven minutes. The animals uniformly experienced dreadful fits of tetanic spasm, and were carried off during a paroxysm. The cause of death appears to be prolonged spasm of the thoracic muscles of respiration. The spasm of these muscles is apparent in the unavailing efforts which the animals make to inspire. The external muscles of the chest may be felt during the fits as hard almost as a bone, and according to an experiment of Wepfer, the diaphragm partakes in the spasm of the external muscles." According to Fouquier the diaphragm is ordinarily feebly and slowly affected by this agent. Hence it is that in the medicinal use of it, the general tetanus which occurs is attended with little danger.—Dict. Mat. Med., vol. vi. p. 559. According to the experiments of Magendie, the division of the spinal marrow and even complete decollation do not interfere with the peculiar action of this substance.

On the human subject the effects are the same as those in animals, and the mode of death is analogous.

"With regard to the dose requisite to prove fatal, the smallest fatal dose of the alcoholic extract yet recorded is three grains." "Hoffman mentions a fatal case caused by two fifteen grain doses of the powder; and in Hufeland's Journal there is another caused by two drachms, which was fatal in two hours."

2. *The Actual Condition of the System as to Disease.*—The action of this substance on the spinal marrow and the muscles is the same in a state of health as in disease, with this very striking difference, which was first observed by Fouquier, and afterwards confirmed by others. In cases of paralysis, the first effects of the remedy are felt in the paralysed

limb. In most cases, when spasmodic contractions begin in the paralysed parts, they do not extend beyond this, unless the dose be considerably increased.

Mode of Administration. 1. *Powder.*—In this form it is seldom given, being uncertain in its effects. It may be given in doses of from four or five grains, repeated three or four times a day, until its effects are felt.

2. *Alcoholic Extract.*—This is a preferable form to the powder, still somewhat uncertain from the variable strength of the article. This may be taken in pill in doses from half a grain to two grains, to be repeated three times a day. This quantity per diem may be increased gradually until the desired effect is produced. "In general, from four to six grains a day will be sufficient to produce tetanic action; but sometimes it has required as much as twenty-four or thirty grains in the day." It is important to recollect, that if the use of the medicine is discontinued, on its being recommenced, the smallest doses must be given, and then gradually increased.

4. *Tincture.*—Ext. nucis vom. grs. iij. alcohol ℥ i. M.—Magendie, p. 16. Of this from twenty to thirty drops may be taken at a time. This is also a good friction to the paralysed part.

Strychnine.—This alkali was discovered in 1818 by Pelletier, who found it in the *Strychnos nux vomica*, and from hence it derives its name. Since then it has been found in the *Strychnos ignatia*, the *Strychnos colubrena*, and in the *Upas tienté of Java.* It exists associated with another vegetable alkali, *brucine*, and both are in combination with *strychnic acid*, formerly called the igasuric acid.

It is obtained by boiling the bruised nux vomica in spirit three times successively, and pouring off and straining the several liquors. Distil off the spirit, and evaporate what remains to the consistence of an extract.

Here the alcoholic extract contains *strychnate of strychnine*, with some admixture. This is now to be dissolved in cold water and strained. The water dissolves out the strychnate of strychnine, and separates some fatty matter united with it. This is then to be evaporated with a gentle heat to the consistency of a syrup, and while warm magnesia is added to saturation. After standing for two days, the supernatant liquor is poured off. The magnesia decomposes the strychnate, forming strychnate of magnesia, which is held in solution, while the strychnine is precipitated.

The precipitate is then to be boiled in spirit, strained, and distilled. To this add sulphuric acid mixed with water, and afterwards solution of ammonia. Here a sulphate of strychnine is formed, which is again decomposed by ammonia, and the strychnine precipitated. This is then again dissolved in boiling spirit and set aside, that pure crystals may be formed.

Properties.—When pure, strychnine is a white crystalline substance;

when obtained by spontaneous evaporation, it is in minute crystals; but when rapidly evaporated, it is in a granular form. It is without smell, but has an intensely bitter taste. The bitter is so intense that it imparts its taste to 600,000 times its weight of water. It requires about 6,600 times its weight of cold and 2,500 times its weight of boiling water to dissolve it. In boiling alcohol it is soluble, but scarcely at all in cold.

Strychnine acts like the alkalies on vegetable colors, neutralizes acids, and forms crystallizable salts. It is unaffected by the atmosphere. "It is neither volatile nor fusible, being melted by heat only at the moment of decomposition, which takes place, however, at a comparatively low temperature."—U. S. Disp.

Purity.—As this article is very expensive, the temptation to sophistication is strong; as the quantity which is used at a dose is small, it is of course very important to have it pure, otherwise constant disappointment must occur during its use.

The articles with which it is most commonly sophisticated are, *magnesia* and *phosphate of lime.* To ascertain the presence of these the following tests will answer:

1. Dissolve in boiling alcohol. If pure it will be entirely soluble.

2. Subject to a calcining heat, with the access of air. If pure it will be entirely decomposed and dissipated.

In its ordinary form it is frequently associated with *brucine.* This is ascertained thus:

1. Moisten the suspected strychnine with nitric acid; if it assume a blood-red color, it contains brucine, if not it is pure.

2. Mix a solution of the strychnine with a solution of chloride of tin; if it produce a brown precipitate, it contains brucine, if not it is pure.—Dom. Chem.

Effects on the System.—These are the same as the Nux Vomica, only more energetic. When given in sufficient quantities it is, next to the Hydrocyanic acid, the most rapid and potent poison we know of. Its terrible effects have been illustrated by numerous experiments upon animals. Dr. Christison killed a dog in two minutes with the sixth part of a grain, injected in the form of alcoholic solution into the chest. A wild boar was killed in the same manner with the third of a grain in ten minutes. Dr. C. thinks there is little doubt that half a grain thrust into a wound might kill a man in less than a quarter of an hour.

Modes of Administration.—The ordinary and best mode of using it is the form of pill made with conserve of roses. The best way is to begin with the 12th or the 18th of a grain, repeated three times a day and increased until the characteristic effects of the article are produced. With respect to giving strychnine in the form of alkali, it is well enough to recollect that the activity of it depends upon the degree of acid in the

stomach.* To obviate the variable effect which might thus be occasioned, Dr. Thomson recommends that it should be given in the form of acetate. This he directs to be prepared by dissolving gr. j of pure strychnine in ʒ j of distilled vinegar. Six minims of this contain one tenth of a grain, which is a good dose to begin with. This may be gradually increased.†

Tincture.—This form is recommended by Magendie:

Strychnine, grs. iij.
Alcohol, ℥ j.
M.

Dose, 6 to 24 drops.

Salts of Strychnine.—Of these there are several. The only one used by Magendie is the *sulphate*. This acts in the same way as the strychnine, only more active. One twelfth of a gr. is a dose.

APPLICATIONS OF NUX VOMICA AND ITS ALKALIES IN THE TREATMENT OF DISEASES.

Serapion appears to have been the first physician by whom the Nux Vomica was used as a medicine. The Arabians gave it as an antidote against the bites of serpents. Between the sixteenth and eighteenth century physicians resorted to it occasionally against a few diseases. It was accordingly used as a remedy for the plague, for tænia, hydrophobia, dysentery, and various nervous affections. It was not, however, until within a few years that any great use was made of it as a remedial agent. In 1811 Dr. Fouquier, reflecting on the fact established by Magendie, in relation to the peculiar action of the Nux Vomica in producing tetanic spasm of the muscles dependent on the spinal marrow, thought it might be applied with advantage in cases of paralysis. He accordingly tried it in a large number of cases, and found it to be a most valuable remedy, proving in many cases a perfect cure. Since the discovery of the strychnine this has been still further tested, and its efficacy in many cases fully established. Like all other remedies, it is by no means infallible. In some cases it does no good, while in others it causes effects which no other is capable of producing. Everything depends upon the nature of the case. Whenever paralysis is the result of some organic derangement of the brain, such as tumors pressing upon the substance of that organ, diseased alterations in its structure, or extravasations of fluid which cannot be absorbed, then this remedy will be of no avail. On the other hand, where the paralysis depends upon simply *diminished nervous excitement*, it has been completely cured by the use of this article. Dr. Thomson says he

* See Thomson, vol. i. p. 256. † Ibid.

considers "strychnine or the ext. of nux vomica most useful in those cases of palsy that proceed from sedative impressions on the intestinal nerves, such, for example, as occur when carbonate of lead taken into the stomach produces colica pictonum; and indeed in every case of palsy of the motor nerves only, which is readily known by the sensibility of the paralytic limb remaining after the power of motion is lost, and by the entire state of the sensorium commune."—Vol. i. p. 255. In paraplegia it has generally been found more successful than in hemiplegia. The first effects of the remedy in all cases are convulsive twitchings of the paralysed parts, and no benefit is derived from its use until this effect is produced and continued for some time. If plethora should be present, this is to be corrected by venesection, purgatives, and other appropriate treatment. It is a great advantage attending the use of this powerful agent (strychnine) that it does not at all impair the tone of the stomach; on the contrary, it has a tendency to increase the appetite and promote digestion. In having recourse to the strychnine, the best way is to commence with small doses, increasing them gradually, according to the effect produced. One eighth of a grain twice a day is sufficient to begin with. This may be cautiously increased to one sixth, one quarter, or even half of a gr. twice a day. Should any unpleasant symptoms occur, of course its use should be discontinued, and when the symptoms subside it may again be resumed. By observing these general precautions, there is no danger in using this otherwise potent agent.

Besides *paralysis*, strychnine has also been used with success in *chronic diarrhœa*. This, as you probably know, is a very serious disease, and sometimes incurable by any means that we yet are acquainted with. In some of these cases, which had obstinately resisted all other treatment, this remedy effected a cure. Whenever any inflammatory condition of the mucous membrane of the intestines is present it is not to be used. When this is not present, and especially when the disease occurs in feeble constitutions and in old people, this remedy is exceedingly advantageous. Besides the effect which it produces on the intestines, it acts as a tonic to the stomach, and in this way, no doubt, aids very materially in effecting the desired relief. One twelfth of a grain two or three times a day is sufficient. In recommending this article, I would not advise you to fly to it at once before trying other means. Your best plan is to reserve it till everything else has failed.

In certain cases of *amenorrhœa*, depending upon diminished action in the uterine vessels and the system, this remedy has also been used with considerable success. It stimulates the vessels of the uterus, and improves the general tone and vigor of the system. A very good plan in these cases is to combine its use with purgatives, especially when there is a tendency to costiveness, as there frequently is.

BRUCINE.—This was discovered in 1818 by Pelletier, and by Caventou in 1819, in the inner bark of the brucia antidysenterica. It there exists combined with the gallic acid, in the state of a gallate. Since then it has been found united with strychnine in the nux vomica and St. Ignatius bean. Brucine a crystalline substance of a white color, destitute of smell, but intensely bitter. In water it is more soluble than most other vegetable alkalies, requiring only 850 times its weight of cold and 500 of boiling water for its solution. In alcohol both cold and hot it is soluble. Tested with nitric acid, it produces a blood-red color.

Effects on the System.—These are the same as the strychnine, only it is less active. It is considered to be about $\frac{1}{12}$ only as active as the strychnine.

Modes of Administration.—*Pill*, of a $\frac{1}{4}$ to $\frac{1}{2}$ gr., to be increased gradually.

CREASOTE.—This is a peculiar substance discovered by Reichenbach. It is obtained from tar and pyroligneous acid.

It is a colorless transparent liquid, of an oleaginous consistence. It has a disagreeable penetrating odor resembling that of smoked beef, with a burning, caustic taste. Its specific gravity is 1·067 at 68° of Far., boils at 397° Far., and is not congealed at the temperature of —16·6° Far. It burns with a smoky flame, combines readily with acetic acid, water, alcohol, ether, and the alkalies. Besides this it possesses the property of coagulating albumen. A drop of it added to an aqueous solution of white of egg, immediately produces particles of coagulated albumen. Fresh meat placed for an hour in a solution of creasote and well dried may be exposed to the heat of the sun without putrifying. In eight days it becomes hard and smells like good smoked meat.

Effects on the System.—Applied to the *tongue* pure creasote produces severe pain. The tongue, however, is neither red nor tumefied, but contracted. Along with this there is a smoky taste in the mouth. Applied to the *skin* it produces a feeling like that of a burn—causes rubefaction, and destroys the epidermis, which splits and falls off in little rough scales. From experiments made upon animals, it appears that creasote acts as an irritant to the surfaces with which it comes in contact, whether this be the skin or the mucous membrane. In its pure state, if taken internally, it proves poisonous and destroys life. As a medicine it can of course be used only in the state of dilution.

As a remedial agent creasote has been used principally as an external application, although in some cases it has been given internally.

Applications in the Management of Diseases.—As an external application there are several important cases in which the efficacy of creasote has been established.

(*a.*) As an application to burns.

(*b.*) As a local stimulant to indolent ulcers and fistulous passages, promoting healthy action and cicatrization.

(*c.*) To carious teeth it frequently answers most admirably, relieving pain with great rapidity.

(*d.*) To restrain hemorrhage. It is only in cases of bleeding from small capillary vessels that it does any good, and it acts here in consequence, no doubt, of the property which it possesses of coagulating albumen. In hemorrhage from large vessels it does no good.

Internally, it has been used in a number of cases.

1. *Phthisis Pulmonalis.*—In this disease, creasote has been recommended as aiding expectoration and also cicatrization of ulcerations. By Dr. Elliotson, of London, it was tried, but, as he says, without any good effect, when given internally. When used in the way of inhalation, however, he reports favorably of its effects. His mode of using it was to put one drop of creasote into rather less than a pint of cold water, and add one drop every time it is employed in order to maintain the strength of the liquid. Through this water the patients were made to breathe for four or five minutes four or five times a day. In those cases in which the ulceration is confined to the mucous membrane and in cases of simple bronchitis, Dr. Elliotson thinks it has been of decided benefit. Also in asthma.

2. *Vomiting.*—As an agent for arresting this troublesome affection, Dr. Elliotson thinks that the efficacy of the creasote is fully established. From the stimulant character of this article, it is only suited to those cases of vomiting in which inflammation or structural disease of the stomach is not present. In all other cases, he has found it eminently advantageous in arresting not merely *vomiting* but *nausea.* In colic, the vomiting attending pregnancy, sea-sickness, &c., he recommends its use. One or two drops in an ounce of water may be given every hour or half hour till the effect is produced.

Modes of Administration.—Internally it is used either in *pill* or *mixture.* One or two drops dissolved in camphor mixture or the same quantity made up into pill may be given three or four times a day. This may gradually be increased to eight drops.

Inhalation.—This may be done either by steeping paper in it and placing this in approximation with the nostrils, or by heating the creasote in the neighborhood of the patient, so that he cannot fail to inhale it, in this way; or a portion of it may be poured into hot water in a Mudge's inhaler, and the creasote vapor inhaled in the usual manner.

Externally it may be applied in the form of *lotion* or *ointment.* The *lotion* is made by adding from two to eight drops to each ounce of distilled water. The *ointment* is made by rubbing up ten drops with an ounce of lard.

For dressing ulcers the creasote water may be used first. Sometimes the purest creasote is used in these cases. To stop hemorrhage the best way is to imbibe a few drops of pure creasote on cotton or lint and apply it.

Common Soot.—This has recently been proposed as a substitute for creasote upon the supposition that it was analogous in its constitution, and such is the fact. The combustion of wood is "a rude, every-day exemplification of the same process" by which creasote is obtained. Upon this principle it has been used by M. Bland, and with success in a number of cases, as an external application. The mode of applying it is to boil two large handfuls of soot in a pint of water for about half an hour and then strain. This to be used as a lotion four times a day. Several cases of *cutaneous* disease have been successfully treated by the use of this lotion.

Acidum Aceticum Empyreumaticum.—This is the *pyroligneous acid*, an impure acetic acid obtained from wood by destructive distillation in close vessels.

Properties.—The pyroligneous acid is a fluid of a brown color, having a strong and smoky smell. Its constituents are acetic acid, diluted with more or less water, holding tar and empyreumatic oil in solution. By purification, it furnishes a strong acetic acid.

Medical Applications.—It is entirely as an external application that it has been used, and in this way it has proved exceedingly useful as a local stimulant to ulcers, gangrene, &c. The first use of it made in this way was by Dr. S. Moore, of this city, in a case of mortification of the cheek. This was in 1821. Although the case did not recover it corrected the fœtor in a decided manner. Since then it has been used with success in gangrene, ulcers, and fungus hæmatodes by Dr. Simons of Charleston and others.

TONICS.

The term *Tonic* is used to designate those agents which have the power of imparting strength and energy to the system. Every substance, therefore, which contributes to the support and sustenance of the body may be considered, in an enlarged sense, as a tonic. In the Materia Medica, however, the term is of more limited application, and it is used only in reference to certain mineral and vegetable substances, whose immediate and primary operation is to quicken the appetite, promote digestion, and augment the strength. This they do even if given in very small quantities. If their use be continued, the system at large feels their influence. The pulse becomes full and strong—without, however, any increase in its frequency—the muscles are more firm and solid, the energy of the brain and muscular system is augmented; in short, there is a general increase in the power of the whole system. In most cases, too, the fluids participate. The blood accordingly increases in quantity, and at the same time assumes a denser and richer appearance. Such, very briefly stated, are the sensible effects of Tonics. For the purpose of ascertaining, if possible, what the changes are which the various organs and tissues of the body undergo all this time, let us analyse their effects a little more in detail.

1. *Of the Local Effects.*—When taken internally the primary effect of Tonics is upon the stomach, and a peculiar impression is made upon the mucous lining of that organ. What the precise nature of this impression is it is not easy to say, and I call it a *peculiar* one, because I conceive it to be different from the impression made by all other classes of medicinal agents. Analogous in many respects to that made by stimulants, it nevertheless differs widely from it in not being followed by any general excitement of the system. In many cases, too, it is associated with an astringent operation, and some of our most valuable tonics are also remarkable as astringents. Notwithstanding this a purely tonic effect may be produced without any astringent; while, on the other hand, many substances act as astringents without being at all tonic. It would seem, therefore, that a purely tonic effect differs from that of a stimulant or an astringent, and the nature of this effect consists simply in an increase of the nervous and muscular power of the part. The evidence of this, of course, is only to be seen in the changes wrought in the functions. Hence it is that tonics quicken the appetite and promote the power of digestion.

Of the Remote Effects. 1. *On the Brain and Nervous System.*—To the brain and nervous system tonics impart force and energy. That such

is really the case is evident, not merely from the general increased vigor of the system, but in a still more striking manner from the powerful effect produced by tonic agents in certain cases of disease in which they are used as antiperiodics.

On the Circulatory and Muscular System.—The action of tonics is here most manifest, and shows itself in the increased force and fulness of the pulse, the more florid hue of the cheek, as well as in the increase of strength in the muscles. On the urinary system tonics produce an effect, generally, no more than can be referred to the improvement they make in the tone and vigor of the system at large. So on the skin the change manifested by heightened color, agreeable warmth, and a soft perspirable surface, is to be attributed to the general effect of what indeed it makes a part, rather than to any specific influence these agents have on the skin. All their effects are probably secondary to the power they have over the function of sanguification. Tonics improve the character of the blood, increase the amount of solids in it, *enrich* it, so to speak, and as a consequence of this change we have the functions of the brain, the lungs, the kidneys, the voluntary muscles, and the skin performed with more energy than before.

Circumstances which Modify the Effects of Tonics.—Like most other medical agents tonics are modified by age, sex, temperament, climate, &c.

As to age and sex a common principle governs. The child and the woman, from their delicacy of constitution, are more easily and often more favorably affected by tonics than the adult or the male. Yet from their greater susceptibility it follows that the agents should be used more carefully. Especially is this true when the antiperiodic effect of tonics is to be obtained. In doing this great caution is necessary, lest the impression be too violent. Pregnant women in particular are likely to suffer in this way; and it was an observation of Dewees, that bark did not act kindly on pregnant women.

Temperament.—The mode in which the action of tonics is influenced by temperament is obvious. Excitable, susceptible persons do not bear tonics well. The same thing is even more obviously true of the sanguine and plethoric. In the languid, torpid, sluggish temperament, on the other hand, and where the tone is below par, and yet the nervous system is not in any excitable state, they show their best powers.

Climate.—The warmer climates, by the increased nervous irritability they produce, render the system generally more susceptible to the action of tonics; on the other hand, in cold climates the dull and inirritable condition of the system renders it comparatively insensible to the operation of these agents. This state and its influence on the effects of tonics is very well illustrated by the diet which the inhabitants of arctic and torrid climates

respectively use. By the former, the grossest food and the most potent stimulants are taken in the greatest quantities, while the other delights in sub. acid fruits, and a diet almost exclusively vegetable. Independent of climate, *season* also influences the operation of tonics.

Mr. Annersley says, that at Ningpua in India, cinchona proved successful in curing agues in the cold weather, while it utterly failed in the hot.*

Repetition.—The effect of tonics is more or less impaired by repetition, the system becoming habituated, so to speak, to their use.

Actual Condition of the System.—The controlling influence which this circumstance has over the effects of tonics, is well seen in the administration of bark in fever. If the system be in a proper state, if it has been prepared for the remedy, a few doses will produce the desired effect, while without such preparation the same impression cannot be made, even by a much larger quantity; frequently, indeed, increasing the dose only increases the difficulty.

States of the System favorable and unfavorable to the use of Tonics.—Of the unfavorable states of the system there are several, which may be specificed, as general plethora, organic disease of the heart, congestions of the large viscera, an excited state of the vascular system, or active hemorrhage. Under any of these circumstances, the impropriety of using tonics is so obvious that no words can make it plainer.

Therapeutic Effects.—Tonics prove curative of disease in two very different modes: first, by increasing the general tone and vigor of the body; second, by making a powerful impression on the nervous system and in that way counteracting or preventing the recurrence of periodical disease. Accordingly there are two diseased conditions of the system in which these agents are resorted to, viz. that which is marked by debility, loss of tone and vigor; second, that of which periodicity is the characteristic element. Of the application of tonics to the first of these two diseased conditions, I need not say much. The use of the remedy flows so naturally from the pathological condition, and is so obviously connected with it, that it rarely gives rise to much difficulty. Two or three cautions are necessary; first, remember that in an over dose almost all tonics are irritants, and will exhaust instead of invigorating the system. Use them, therefore, always in moderate doses. Second, the vegetable tonics are always safer, and very generally more effectual in removing debility. To this the only striking exception is where the debility is the direct consequence of the loss of blood. In this case the chalybeates are to be preferred. Third, tonics will never produce a good effect unless the digestive organs are properly prepared for their use. This principle lies at the very foundation of all successful use of tonics in diseases of debility.

* Thompson, vol. i. p. 70.

Tonics as Antiperiodics.—Here the operation of the tonic differs widely, not in degree, but in kind, from its invigorating influence. We desire not to give tone to the stomach, vigor to the muscles, energy to the brain, to augment the vital power throughout the system. Nothing of this sort is aimed at. We desire to make upon the nerves, the brain, indeed upon the whole system, an impression, excite, if you please, an irritation which shall put an end to the paroxysms of the disease we combat, by rendering the system insusceptible of it. This is the true theory of the curative influence which some tonics, though by no means all, have over periodic disease. Of the mode in which this effect can be secured with the most certainty and the least danger, it is necessary that you be well informed. The rules according to which antiperiodics should be given, are:—

1st. They best succeed where the periodic disease is simple: has no attendant inflammations or congestions.

2d. If the heart and arteries are very active, pulse full and frequent, skin hot, antiperiodics are far less likely to succeed than in an opposite state of the circulation.

3d. They have a more decided control over intermittent than remittent diseases; the latter they often fail to cure, and not very unfrequently aggravate.

4th. They very rarely succeed where the stomach is foul and the bowels costive. Proper purgatives should *always* precede the use of antiperiodics, otherwise it is generally ineffectual, and often, perhaps always, unsafe.

5. Antiperiodics should usually be given during the intermission or remission of the disease. This rule, however, is not absolute, as it was formerly considered. Antiperiodics may sometimes produce excellent effects when given during the hot stage.

6. They may be given either in moderate doses, continued for a number of days, with a view of assisting the system in *wearing out* the disease, or they may be given in a single intermission in large doses, so as to produce their specific irritation on the system, and thus strangle the disease at once. When this effect results from the use of quinine, it is called quinization or cinchonization. This mode of using either the bark or any of the forms of quinine is not, when properly watched, dangerous. Arsenic is much more dangerous, and though it may be (for it has been) given in large and rapidly repeated doses, yet the danger is by no means trifling.

INDIVIDUAL TONICS.

Calumba.—This is the product of the *Cocculus palmatus*, a climbing plant, growing native in the forests of Mozambique, on the south-eastern coast of Africa. For many years it was supposed to be a product of Ceylon,

and to derive its name from the principal town in that island, from whence it was exported. All this, however, is found to be a mistake, and the name is derived from the Mozambique name of the root. The root is perennial, and dug up by the natives in the dry season (March). The offsets from the main root are the part used. These are cut into slices and dried in the shade. In this state it is sent to India, and from thence exported to different parts of the world.

As found in the shops, the calumba root is in small round pieces about one third of an inch in thickness, and from one half to three inches in diameter. Sometimes it is in cylindrical pieces one or two inches long. The cortical part of these pieces is externally of a dark brown color—internally of a light yellow. It is thick and easily detached. The internal or the medullary part of it is of a yellowish green color, light, spongy, and shrunk, and marked with concentric circles and radiating lines. Frequently the pieces are perforated with holes, occasioned by worms attacking the starch. The calumba has a faint aromatic odor, and a bitter taste.

The best pieces are those which are heavy and solid; they are brittle and easily pulverized; the powder has a brownish yellow color. According to analysis, this root contains as its principal constituents a peculiar bitter principle, called calumbin, gum, and a large proportion of starch. This latter constitutes about one third part.

Calumba is soluble both in water and in alcohol.

Adulterations.—The genuine calumba root is said to be very scarce, and the roots of other plants are frequently sold for it. In France there is a false calumba sold which comes from the northern coast of Africa, differing entirely from the real article. In this country, also, we have an article which is sold for the real calumba. This is the *American Calumba*, the product of the *Frasera walteri*, a plant growing in the south and west of the Alleghany Mountains, but never found on the east of them. This is distinguished:

1. By the difference in external appearance. The internal structure of the Frasera is more uniform, the concentric and radiating lines are absent, and they have a purer yellow color instead of a greenish tinge. Their taste is brittle and sweetish.—U. S. Disp.

(*a.*) *Chemical Tests.*—A decoction of genuine calumba, when cold, forms with a *solution of Iodine* a blue color (Iodide of Starch); with the frasera it produces no change, showing the absence of starch.

(*b.*) *Tincture of Galls* throws down a precipitate from infusion of genuine calumba—(Tannate of Starch)—does not affect that of the frasera.

(*c.*) *Sulphate of Iron* does not affect the infusion of the calumba, showing the absence of Tannic acid. With the infusion of frasera, it produces a blackish green color.

(*d.*) *Gelatine.*—This does not affect infusion of true calumba, but with frasera it throws down a precipitate, showing the presence of *Tannic* acid.

The chemical difference, then, between them is that the true calumba contains *starch* without any *tannic or gallic acids*, while the frasera contains no starch, but tannic acid.

Effects.—This is a most valuable article and peculiar in its effects. It is a pure bitter tonic, without any astringency. Its operation is chiefly on the stomach and digestive organs. It improves the appetite, assists digestion, and corrects the gastro-intestinal secretions. It sits easy on the stomach, and sometimes allays vomiting. This may partly be owing to the combination of such a large proportion of starch, giving it a mucilaginous character. Upon the general circulation calumba does not exert any influence. First introduced into Europe, 1685.

Forms of Administration.—1. *Powder.*—In doses of from grs. x to grs. xxx.

Infusion.—℥ss of calumba sliced. Boiling water two pints; macerate for two hours and strain.

Dose.—℥ij two or three times a day. This does not affect the salts of iron, and therefore is a good vehicle for giving them.

Tincture.—ʒj to ʒij.

Quassia Excelsa.—This tree grows in the woods of Surinam, Jamaica, and the Caribean islands. It is a beautiful tree, rising frequently to the height of one hundred feet, and often ten feet in circumference near the base. The part used in medicine is the *wood of the trunk and branches.* As found in the market imported from Jamaica, it is in billets of various sizes, several feet in length, and from an inch to a foot in diameter. At first it is of a whitish color, but on exposure to the air turns yellow. It has no smell, but a taste intensely bitter, more so than that of almost any other known substance. It is destitute, however, of acidity and astringency. It is with great difficulty reduced to powder.

According to analysis, its chief constituents are a small proportion of *volatile oil*, a *peculiar bitter principle* (Quassia, or Quassite), *gummy extractive—pectin, lignin*, and various *salts.* All the active properties of Quassia are taken up by water and alcohol, and the infusion, decoction, and tincture are all equally bitter.

Effects.—Quassia is one of the purest of the simple bitters in our possession. It acts as a tonic to the digestive organs, without producing any stimulant or astringent effects. It was first introduced into Europe about 1756. This is used by the brewers to impart bitterness to beer.

Form of Administration.—From the difficulty of pulverizing it, it is not given in powder.

Infusion.—Rasped wood ʒij; water, pint; macerate twelve hours and strain—dose ℥ij three or four times a day. This does not affect the Salts of Iron.

Tincture.—ʒj to ʒij.

SIMARUBA.—The tree which yields this is the *Quassia simaruba*, growing native in Guiana and the West Indies. It is a tall tree, and the part used in medicine is the *bark of the root.* The wood is tasteless and inert. The bark is imported from Jamaica in bales. It comes in thin long pieces several feet in length, and a few inches in breadth. It is folded lengthwise, fibrous in its structure, flexible and tenacious. Externally its color is a greyish yellow, internally pale yellow. It is destitute of smell, and has a bitter, but not astringent taste.

According to analysis, it contains *Quassia, resinous matter—an aromatic oil, having the odor of benzoin—malic and gallic acids*, in very small proportion—*malate and oxalate of lime—oxide of iron—silica—ulmin and lignin.*

Both alcohol and water extract the active properties of this bark.

Effects.—Analogous in its effects to Quassia, and the other simple bitters. It acts as a tonic to the digestive organs, and has been used in cases where they are debilitated. It was first introduced into France in 1713 as a remedy in dysentery, and became quite celebrated for a time. At present it is not much used.

Mode of Administration.—From the difficulty of pulverizing it is not much used in powder.

The best form is that of *infusion.* This is prepared by macerating for two hours in a covered vessel half a drachm of the bark in half a pint of water, and straining.

Dose.—℥j to ℥ji.

GENTIAN.—This is the product of the *Gentiana lutea*, a perennial plant growing indigenous on the Alps, Apennines, and Pyrenees. It is about three or four feet high. The part used in medicine is the *root.* This is collected and dried by the peasants, and imported in bales.

As found in the market this is in pieces of a foot or more in length and one or two inches thick, twisted and wrinkled externally. The texture of the root internally is spongy; externally the color is yellowish brown, internally yellow. The smell of this root is slightly nauseous, and its taste intensely bitter, without being astringent. It yields a powder of a yellow color.

The constituents of gentian are a *bitter crystalline matter* (gentianin), *volatile odorous principle, yellow coloring matter, green fixed oil, uncrystallizable sugar, gum, wax, oil, caoutchouc, lignin,* and a *free organic acid.*

The taste and virtues are extracted both by water and alcohol.

Effects.—This is another simple bitter, having no astringency or aroma, producing all the effects of a pure tonic. Generally speaking, it does not cause any vascular excitement. If, however, it be taken in too large quantities or continued too long, this effect is produced. As a medicine gentian has long been known. It is said to have received its name from Gentius,

one of the kings of Illyria, who was conquered by the Romans about 160 years before Christ.

Forms of Administration. Powder.—Ten to thirty grains.

Compound Infusion.—Made with bruised gentian, orange peel, coriander seed, and a little diluted alcohol. Tonic and stomachic; dose ℥i to ℥ij three or four times a day.

Compound Tincture.—ʒi to ʒ ij.

Extract.—Dose, grs. x to ʒss.

Gentianin.—The peculiar principle contained in the gentian, neither acid nor alkaline. Its effects are the same as the root. It is expensive, however, and possesses no advantages.

Dose in pill one gr. two or three times a day.

American Gentian.—Of these there are a great number growing in different parts of the United States. They are very similar in their properties to the European, and may be used in the same way, and for similar purposes.

Cinchona.—The cinchona constitutes an extensive genus of plants, growing at various elevations on the Andes, in South America. The precise number of species embraced under it is by no means settled by botanists. Acccording to Humboldt there are eighteen, Decandolle makes sixteen, while others make as many as twenty-four. Notwithstanding, too, all the labor and research which have been spent upon the subject, it is still left doubtful from which of the species the different kinds of bark used in medicine are obtained. It will therefore be quite unnecessary, in a practical point of view, to give any account of the different species which have been described by botanists.

The cinchona tree is of considerable size, varying in height from fifteen to thirty and forty feet. The mode of obtaining the bark is to strip it from the trunk and branches, and afterwards dry it in the sun. The period for doing this is the dry season, that is, during the months of September, October, and November. During the process of drying the bark becomes variously quilled; the degree of it depending on its age and thickness. After being properly dried it is assorted and packed in cases, or, as they are called, *ceroons*. These are exported from various ports of the Pacific coast of South America.

History.—By whom or when the medicinal properties of the bark were discovered is not precisely known. By some it is supposed that they were known to the Peruvians long before the conquest of their country by the Spaniards. This, however, is rendered highly improbable by the statement of the celebrated traveller, Humboldt, who says that the use of the cinchona "is entirely unknown to the Indians generally in that country;" and he adds, that even at the present day the people of South America have a great antipathy to the use of this article, and in the treatment of

their fevers in the very country in which this tree grows, they trust entirely to other remedies. Humboldt adopts the opinion that the discovery was accidentally made by the Jesuit missionaries, some of whom were generally well instructed in medicine. What, however, more immediately brought the bark into notice was the circumstance of the Countess of Cinchon, wife of the viceroy of Peru, being cured of intermittent fever by its use. This took place in 1638, and in the following year the viceroy returning to Spain carried some of it with him. This probably was the first introduction of this important article into Europe. Although urged to it, the Spanish physicians did not make much use of it immediately, and its spread through Europe was chiefly owing to the Jesuits. One of this fraternity in Italy, a Spaniard by birth, the Cardinal de Lugo, was the chief agent in promoting this business. At his request, Pope Innocent X. ordered the bark to be examined by his first physician, who declared it to be not merely innocent but salutary. Papal patronage being now extended to it all opposition ceased at Rome, and this place became its principal mart. In 1649 the provincial fathers of the Jesuits brought a large quantity of it from Peru, and an assembly of the order from different parts being held about that time, it was distributed on their return in every country in Europe. It is from these circumstances connected with its history that this medicine has derived most of the names by which at various periods it has been known, such as the *cortex* and *pulvis comitissæ*, *cortex* and *pulvis de Lugo*, *pulvis Jesuiticum*, *pulvis patrum*.

As connected with the history of this medicine, it is not a little singular that the most violent and absurd prejudices existed against its use for a long time after it was first introduced into practice. By some this was carried so far as to assert that those who took it would certainly die in the course of a year. In 1652 Leopold, Archduke of Austria and Governor of the Netherlands, was seized with a double quartan, for which he took the bark. As the cure proved only temporary, and the fever returned in thirty days, he ordered his physician, John Jacob Chifletins, to publish a history of the case, with the view of dissuading from the use of so deceitful a remedy. Notwithstanding this it secretly gained ground, and in consequence of the traffic in it being chiefly monopolized by the Jesuits, the price became most exorbitant. On some occasions it was actually sold for its weight in silver and gold. In England it was chiefly brought into vogue by a physician of the name of Talbot, who cured agues by a new remedy, which was ascertained to be entirely made of cinchona. So great a reputation did he acquire that he was sent for to France, and cured the Prince de Condé, and Colbert, minister of France. "In 1679 the Dauphin son of Louis XIV. suffered from an ague which the Paris physicians could not cure. Talbot was called to Paris, and the physicians thinking it proper to examine his scientific acquirements, began by asking him, 'Quid est febris?' The Englishman frankly answered, 'I do not know; you, gentle-

men, may explain the nature of fever, but I can cure it, which you cannot.' This finished the examination. The Dauphin took the remedy and was cured."—Edinb. Med. and Sur. Jour. vol. xxvii. p. 126.

As the reward of Talbot's success, it is said that Louis bought the secret for 2,000 louis d'ors and an annual pension of 2,000 livres. Besides this Talbot obtained letters of nobility and a monopoly of the article for ten years. In consequence of this the price of Talbot's remedy rose to a most extravagant height—a single dose of it cost a louis d'or, and a pound was sold for 100 louis.

Physical Properties.—The Peruvian bark as found in the market comes in pieces of various sizes; some quilled, others flat, of different colors. They all have a bitter sub-astringent taste and an aromatic odor, differing very much, however, in intensity.

Varieties of Bark.—The varieties of the Peruvian bark are exceedingly numerous, and different classifications of them have been proposed. The one most generally adopted is that founded on their color, and for practical purposes this is the best. They are accordingly divided into the *pale barks*, the *yellow barks*, and the *red barks*. These are again divided into two classes according to the color of the epidermis. We have then,

1. *The barks with a brown epidermis*, pale, yellow, and red.
2. *The barks with a white epidermis*, pale yellow, and red.

Of the barks with a brown epidermis.—These come from various parts of Peru and Quito in South America, and contain varying quantities of cinchonine and quinine.

The pale barks.—These come in quills without any flat pieces. They are of various sizes, from five or six to eighteen inches in length, and from two lines to an inch in diameter. They come both in single and double quills. The exterior is covered with a brownish epidermis and is marked by transverse cracks or fissures. They are also frequently covered with lichens. Internally they are of a cinnamon color, varying in the shade in different varieties. The *powder* which they yield is of a *pale fawn color*, differing according to the quality of the bark. Their taste is astringent and bitter, without being unpleasant. In substance they have no smell, but during decoction an aromatic odor is developed. When broken the small quills have an even fracture; the large ones have a somewhat fibrous fracture. These barks contain both cinchonine and quinine. The proportion of *cinchonine* is, however, larger than that of *quinine*, differing in this respect from the other barks.

There are several varieties belonging to the class of pale barks, which are known in commerce. The most important are the following:

(*a.*) *The Loxa Bark.*—So called from the province from which it comes. The finest kinds are also known by the name of *crown bark*, from the fact of having been selected specially for the use of the royal family in

Spain. This bark is generally admitted to be the product of the *Cinchona condaminea.*

(*b.*) *The Lima Bark.*—In Germany called the *Huanuco Bark.* The first of these names is derived from the port from which it was exported. The second from the city *Huanuco*, near which the trees grow.

In England this bark is called the *silver* or *grey* bark. The tree from which this bark is obtained is not ascertained.

Besides these there are also:

(*c.*) The *Jaen Bark*, or ash bark.

(*d.*) The *Huamalies* or rusty bark, names derived from the places from which they come.

In this country all the pale barks are known in commerce by the name of *loxa barks.* [U. S. Disp.] From the fact that the pale barks contain so small a proportion of *quinine*, they are not much used, and the sale at present is very limited.

2. The *Yellow Bark.*—In the market the yellow bark is known by the name of the *Calasaya bark*, from the name of the province in Peru where it is collected.

It comes both in quills and in flat pieces. The quills are distinguished from the pale bark by being generally larger and thicker, the epidermis is rougher and the texture of the bark more fibrous. The *taste* is more bitter than that of the *pale*, with *less astringency.* Its color is *orange yellow.* It yields a powder of the same color.

In its chemical composition *it differs from the pale in its containing a larger proportion of quinine than cinchonine.*

There are two varieties of this bark found in the market.

1. *The quilled Calasaya Bark.*
2. *The flat Calasaya Bark.*

Both these come from the same tree; the only difference being the quilled is taken from the smaller and the flat from the larger branches.

Though generally supposed to be the product of the *cinchona cordifolia*, it is by no means settled.

3. *The Red Bark.*—This is so called from its color. Like the Calasaya bark, it comes both in quills and flat pieces. They vary in length from two or three inches to one or two feet, and are covered with a rough epidermis. The color of the powder is reddish brown. The taste bitter and astringent, though less so than the pale. This bark yields *large proportions both of quinine and cinchonine.* The tree yielding it has generally been considered to be the *cinchona oblongifolia.* The recent researches of botanists, however, have left it uncertain what the tree is.

The foregoing are the genuine cinchona barks.

II. *Of the Cinchona Barks with a White Epidermis.*—These are known by the name of *Carthagena* barks, from the place of their exporta-

tion. In English commerce they are looked upon as *spurious* kinds of bark. [Pereira, vol. ii. p. 988.]

All these have a whitish micaceous epidermis.

They contain only small proportions of cinchonine and quinine. One of them contains a peculiar alkali, called *aricinine.*

There are several varieties of these barks distinguished by their color—the *pale*, *yellow*, and the *red.*

All have a less bitter and more nauseous taste than the preceding.

Besides the foregoing there are a set of barks which are called the *false cinchona barks.* These, from their resemblance in external appearance to the cinchona barks, have been at different times introduced into the market as such. They are not, however, the product of the cinchona, but of other trees, and contain neither *quinine*, *cinchonine*, nor *aricinine.* Among them are the St. Lucia bark, the Caribean bark, etc.

Chemical Composition.—Although subjected to a great number and variety of analyses, the chemical composition of the Peruvian bark was very imperfectly understood until within a very recent period. The first approximation to any acquaintance with the true principle of this drug was made by Dr. Duncan of Edinburgh in 1803. It had for some time been known that an infusion of nutgalls produced a precipitate with infusions and decoctions of bark, and as this precipitate differed both from gelatine and starch, the only other substance capable of precipitating infusion of galls, Dr. Duncan considered it as a *new and distinct principle*, which he called *cinchonin.* A Portuguese physician by the name of Gomez prosecuted the investigation of this principle still further, and in 1810 described its properties when obtained in a state of purity. It was reserved, however, for two distinguished French chemists, Pelletier and Caventou, to ascertain the true character of this principle, and to show the state of combination in which it exists in the different kinds of bark. By them it was shown that *cinchonine* is a *vegetable alkali*, and that it exists in combination with a peculiar acid, which they called the *kinic acid.* In addition to this they discovered the existence of another vegetable alkali, which they called *Quinine*, existing also in the same state of combination, These important discoveries were established in 1820. At a later period (1829) the same chemists discovered another alkali in a new kind of cinchona. This they called *Aricinine.*

According to the analysis of these chemists, the *genuine Peruvian barks* contain the following constituents :

1. *Kinate of Cinchonine.*
2. *Kinate of Quinine.*
3. *Kinate of Lime.*
4. *Tannin.*
5. *Red coloring matter*, insoluble (Red Cinchonine).
6. *Yellow coloring matter.*

7. *Green fatty matter.*
8. *Starch.*
9. *Gum.*
10. *Lignin.*

Between the three varieties, pale, yellow, and red, the only difference is the proportion of these constituents, with the exception that the *pale* is the only one which contains *gum.* They all contain cinchonine and quinine, but in different proportions. The *pale* contains most cinchonine, with very little quinine. The yellow contains most quinine, with little cinchonine. The red contains quinine and cinchonine in nearly the same proportions.

The *Carthagena barks* contain the same constituents, but with very small proportions of cinchonine and quinine. The *pale barks* contain none of either.

Cinchona bark is soluble in water, wine, and alcohol, most so in the two last. Cold water infused upon bark for a certain length of time acquires the bitter taste and odor of the article. If assisted by moderate heat, the infusion becomes stronger, and while it continues warm is perfectly transparent, but as soon as it cools becomes turbid. By the addition of the mineral acids, particularly the sulphuric, the solubility of the active principles of the bark is increased. This acid decomposes the kinates and forms sulphates of cinchonine and quinine.

Adulterations.—There is, perhaps, no medicine which has suffered so much from this cause as the bark. According to Dr. Paris, it "fell into that discredit in the year 1779, from its inability to cure the ague, and it was afterwards discovered to have been adulterated with bark of an inferior species: indeed Sydenham speaks of the adulteration of this substance before the year 1678; he tells us that he had never used to exceed two drachms of cinchona in the cure of any intermittent, but that of late the drug was so inert, rotten, and adulterated, it became necessary to increase its dose to one, two, or three ounces," p. 62. The frauds which are practised in relation to this article consist not merely in using inferior kinds of bark, but in using the dregs which are left after making infusions, decoctions, and tinctures. These reduced to powder are of course totally inert. In London this kind of fraud is practised to a great extent. The only way to avoid this is to procure the bark in its entire state, and not in the form of powder.

Mode of ascertaining the quality of the Bark.—The best kind is that which contains the most *tannic acid* and the most of *the vegetable alkalies.*

Tests for Tannic Acids.—1. A *solution of gelatine* throws down a white precipitate from infusion of bark (*Tannate of Gelatine*).

2. A *solution of persulphate of iron* throws down a green precipitate (*Tannate of Iron*).

3. A *solution of Tartar emetic* throws a dirty white precipitate (*Tannate of Antimony*).

Test for the Vegetable Alkalies.—The best is *Tannic acid.* This throws the alkalies in the form of tannates. Infusion of nut-gall is the form in which this test is used, as it contains large proportions of tannic acid.—Pereira, p. 998.

The best bark, therefore, is that which throws down the most copious precipitate with the foregoing tests.

Effects of Cinchona.—Cinchona possesses in an eminent degree all the properties of a tonic. Its primary operation is on the stomach. When given in small quantities, it simply excites the natural functions of this organ, quickens the appetite, and promotes digestion. If the quantity be large, it frequently excites local heat and irritation, not unfrequently accompanied by nausea, vomiting, and purging. If the use of it be continued the system at large participates in its effects. The pulse becomes fuller, stronger, and more frequent, the head is affected with a sense of fulness and tension, and sometimes actual pain; the secretions are impaired, and a general state of excitement is induced. When given in states of debility none of these effects appear, and the only evidence of action of the article is to be found in the increased strength and tone of the system.

Independent of the general effects which cinchona produces as a tonic, it exercises a peculiar power in controlling and arresting intermittent disease. Although there are other tonics which possess this property, there is none, with the exception of arsenic, which can at all be compared to it.

[Of the precise mode in which barks and other so called tonics interrupt paroxysmal disease, nothing is certainly known; the best opinion seems to be, that they excite a new action incompatible with the diseased action, producing what may be called constitutional counter-irritation.—Ed.]

Mode of Administration. 1. *Substance.*—In the form of powder it may be given in doses of ʒss to ʒj mixed in a glass of port wine or some aromatic—to be repeated three or four times a day, or oftener if the stomach will bear it. The great objection to this form of giving the bark is, that it contains such a large quantity of inert ligneous matter, which frequently loads the stomach to such a degree as to render purgatives necessary. Sometimes, too, it irritates the bowels and produces catharsis. At present the bark is not given in this form, being in a great measure superseded by the sulphate of quinine.

2. *Infusion.*—The simple infusion is prepared by putting a pint of boiling water on an ounce of bark. Let it macerate for two hours in a covered vessel and then strain.

Prepared in this way the infusion contains very little of the alkaline principles of the bark—the greater part of them remaining behind. On this account it is a feeble preparation. The activity of it may be greatly increased by the addition of ʒi sulphuric acid. This converts the kinates of cinchonine and quinine into *sulphates*, which are soluble. The dose is ℥j to ℥ij three or four times a day.

From the mildness of this preparation it is only suitable as a stomachic, not febrifuge.

Alkalies, alkaline earths, and vegetable astringents are incompatible with it.

3. *Decoction.*—This is prepared by boiling an ounce of bark in a pint of water for *ten* minutes in a covered vessel, and straining while hot. Long boiling greatly impairs the virtues of the bark. On this account it is limited to fifteen minutes. Even in this way the liquor, on cooling, deposits a precipitate and becomes turbid. In consequence of this deposition the decoction is reduced to the strength of the ordinary infusion, and therefore to obtain the full strength of this preparation, it ought to be drunk warm, or it should be stirred up before taking it. To obviate this, the best way is to add a drachm of sulphuric acid, for the purpose of converting the kinates into soluble sulphates. Dose ℥i to ℥ij.

4. *Tincture.*—This is prepared by macerating six ounces of bark with two pints of diluted alcohol for fourteen days and then filtering. This contains a considerable quantity of the active principles of the bark; but from the large proportion of spirit which enters into it, it cannot be given in doses sufficiently large to obtain the antiperiodic effects of the bark. It is chiefly used, therefore, as an adjunct to the infusion or decoction. In doses of ʒi to ʒiv it may also be used as a stomachic.

Compound Tincture of Bark.—This is the celebrated tincture of Dr. Huxham. It is more agreeable to the stomach than the other tinctures of bark. Though it contains less of the bark, yet from the addition of the other ingredients it is frequently more useful as a febrifuge and stomachic. With Huxham it was a favorite remedy in intermittent and low nervous fevers, and it was generally given by him in diluted wine with the addition of ten or fifteen drops of elixir vitriol; dose ʒi to ʒij.

5. *Extract.*—According to the United States Pharmacopœia this is prepared by macerating bark in powder in alcohol for four days, then boiling the residuum in water. Evaporate the two liquids till they become of the consistence of honey; then mix them and evaporate to a proper consistence. By the use of alcohol and water all the active properties of the bark are retained in the preparation.

This is a good form of giving bark. Dose ten to thirty grains in pills, or mixed with syrup.

VARIOUS MODES OF ADMINISTERING BARK.

1. *By the Stomach.*—The ordinary and preferable mode.

2. *Applied to the Skin.*—The way formerly in use was to apply what was called the *bark jacket.* This was made by quilting two or three ounces of finely-powdered bark in a silk or muslin handkerchief, to be worn

next the skin around the waist. Applied in this way the bark has frequently succeeded in arresting intermittent fever.

3. *By the Rectum.*—In this way the effects of the bark may also be obtained. For this purpose ʒij of the powder may be injected with three or four ounces of thin starch; or three or four ounces of the decoction with a drachm or two of the powder; and to retain it, ten or fifteen drops of laudanum may be added.

Of the Vegetable Alkalies in the Cinchona.—These are three, *quinine*, *cinchonine*, and *aricinine*. The most important of these is the first:

1. *Quinine.*—As already stated this exists in the greatest abundance in the *yellow* or *calysaya bark*. It is a white substance; without smell, and intensely bitter. As usually prepared it is not crystallized, though it may be so by care; nearly insoluble in water; readily soluble in alcohol (especially when hot) and in ether. It possesses alkaline properties, and unites with the acids forming salts. Infusion of nutgalls throws down a precipitate from infusion of quinine (tannate of quinine). The only salt of this alkali much used is the *sulphate.*

Sulphate of Quinine.—This is prepared by boiling yellow bark in powder with distilled water acidulated with sulphuric acid. This is then to be strained. To this add powdered quicklime, which throws down a precipitate. This precipitate, after being washed with distilled water, is to be dried, and then digested in alcohol with a moderate heat; the alcoholic solution is then to be poured off from the residuum, and put into a still or retort and evaporated, till a brown viscid liquid remains in the retort; this is removed from the retort, and as much diluted sulphuric acid added as will completely saturate it. Animal charcoal is then added, and having evaporated the liquor sufficiently, filter it while hot and set aside to crystallize.

The *rationale* of this process is the following: The object of the first part of the process is to make a *sulphate of quinine*, which is soluble in water; in the state of kinate it is not soluble. In the first boiling, then, you have the sulphate of quinine in solution, but mixed with various impurities.

The object of the second part is to separate these impurities. This is done by adding lime; this decomposes the sulphate of quinine, and throws down a precipitate composed of *sulphate of lime* and *quinine*, both of which are insoluble, leaving the impurities in the water.

The object of the third part is to separate the sulphate of lime from the quinine. This is done by boiling in alcohol, which dissolves the quinine, but has no effect on the sulphate of lime. The pure quinine is thus obtained in solution in alcohol; the animal charcoal is added to remove the coloring matter, and the alcohol got rid of by evaporation.

The object of the last part is to obtain a *sulphate of quinine*, by saturating quinine with diluted sulphuric acid.

Physical Properties.—This salt exists in fine, silky, needle-shaped crystals, flexible, and of a pearly aspect. Its taste is intensely bitter. By exposure to heat it melts and is completely volatilized. In cold water it is very slightly soluble. In alcohol, it is very soluble, and slightly in ether. With sulphuric acid it forms a *super-sulphate*, which is much more soluble in water than the neutral sulphate.

Chemical Composition.—Sulphuric acid, quinine, and water.

Adulterations.—Being an expensive article, strong temptations are held out to its adulteration. From the small quantity that is used at a dose, it is evident that a very slight sophistication would greatly impair its effects. The purity of the article, therefore, is a matter of great practical importance.

It is adulterated with *sulphate of lime, gum, starch, sugar, stearin, salicine.* To ascertain the presence of these the following tests may be used:

1. *Heat.*—If you put a little of the substance on a piece of unglazed porcelain or common tobacco pipe and apply heat, the pure sulphate of quinine will first *melt*, and spread a little; it then turns to black and burns away, leaving nothing but a dark stain, with the peculiar smell of the bark. If any earthy matter be present, this is left on the pipe. This detects *sulphate of lime, carbonate of lime, etc.*

2. Dissolve a little of it in pure water and boil it in a silver spoon. If it be pure the solution will remain *transparent.* If adulterated with starch, flour, or any similar substance, a paste will be formed. If the sulphate of lime, &c., the solution will not remain transparent.

3. *Digesting in Alcohol.*—If it be digested in alcohol the sulphate of quinine will be dissolved, while the gum, starch, or any alkaline or earthy sulphates will be undissolved.

4. To detect *fatty matter*, dissolve in water acidulated with sulphuric acid. This dissolves the quinine, but does not the fatty matter.

5. To detect *starch*, add a solution of Iodine. With starch this strikes a *blue* color; with pure sulphate of quinine, it throws down a precipitate of a brown, cinnamon color.

6. To detect *sugar*, dissolve the sulphate in water and add carbonate of potash. This precipitates the quinine, while sulphate of potash and sugar remain in solution. The sugar may be detected by its sweet taste or by evaporating the liquid to dryness, and digesting the residue with alcohol, which dissolves the sugar, and affords it on evaporation.

7. To detect *salicine*, add sulphuric acid. This turns it red. [Pereira, p. 1015. Murray, p. 382.]

Effects.—The sulphate of quinine produces the same effects on the system as the bark itself, and may, therefore, be used as a substitute for it. In the smallness of the doses in which it is required to be given, as well as its sitting easy on the stomach, it possesses great advantages; so great, that it has nearly superseded the bark itself.

It may be given in powder, pill, or solution. In solution it requires the addition of a little sulphuric acid to make it soluble. A good preparation is the following :—

℞. Sulph. Quinine, grs. xii.
Acid. Sulph. diluted, gtt. xii.
Sac. Alb.
Pulv. Gum Arabic, āā ʒi.
Aq. Cinnamom. ℥iss. M.

The dose varies with the object had in view. When given as a simple tonic, one gr. three times a day. When given to arrest intermittent fever, one gr. may be given every two hours. By some 5 or 6 grs. are given at once. 12 grs. of the sulph. quinine are equal to one ounce of bark.

Various modes of giving the Sulphate of Quinine.

1. By the *Stomach.*

2. By the *Endermic method*—applying it to the skin. In this way it produces all its effects on the system, and effectually cures intermittent fever. Three or four grains of it finely pulverized are to be sprinkled upon the denuded cutis, and repeated every four or five hours.

3. By the *rectum.* This is a good mode of giving it and acts very effectually. The quantity must be two or three times greater than that required by the stomach. It may be mixed with a couple of ounces of starch. I have arrested intermittent fever in this way.

Besides the *Sulphate of Quinine*, there are other salts of this alkali which have been used, such as the *phosphate*, the *acetate*, and the like. They all operate in the same way, but do not possess any advantage over the sulphate.

2. *Cinchonine.*—This is another of the alkaline principles existing in the bark. It is found in the greatest abundance in the *pale bark*, and exists in the state of kinate. *Cinchonine* is a white crystalline substance, without smell and with a bitter taste, which at first is not perceptible, in consequence of its difficult solubility in the saliva. Its solutions are very bitter; in cold water almost insoluble; in hot water slightly soluble; In alcohol, especially boiling, very soluble; with the acids it unites, forming crystallizable salts. The only form in which this alkali has been used in medicine is that of the *sulphate.* In its operation it is very analogous to the sulphate of quinine, and is used in the same way and in the same doses. It is, however, scarcely at all employed.

3. Aricinine.—This is another alkali discovered in the Arica or Cusco bark. It is a white crystallizable substance, resembling cinchonine in most of its properties. It has not yet been used in medicine.

Therapeutic Applications.—Bark or rather its alkaloids, for in substance it is scarcely at all given, is used almost entirely as an antiperiodic, and as such, the number of diseases which are found to yield to its power is

much greater than was formerly supposed. Wherever the element of periodicity characterizes a disease, quinine may with confidence be appealed to, and will not often disappoint our hopes.

Cornus Florida.—The *common Dogwood*, also called the *New England Boxwood.* This is a forest tree, found in every part of the United States, although it abounds most in the middle States. It is slow in its growth, and the height to which it attains is from fifteen to twenty and sometimes thirty feet, with a diameter of from four to six inches. In the spring it bears a profusion of beautiful large white blossoms, which are succeeded in the autumn by clusters of berries of a rich red or crimson color. These berries have a bitter taste, and are fed upon by several species of birds.

The part used in medicine is the *bark* of the root, stem, and branches, all of which possess medicinal properties, though that of the *root* is the best. As found in the shops, this is in pieces of various sizes more or less rolled, of a brownish color externally and yellowish within. It is very brittle, and yields a powder of a brownish color; it has little or no smell, taste bitter, astringent, and somewhat aromatic.

According to analysis, this bark contains *tannin, gallic acid, gum, resin, bitter extractive, and mucilage.* By Dr. Carpenter of Philadelphia, it is said also to contain a peculiar principle, to which he has given the name of *Cornia.* The existence of this principle is, however, doubted by some.

The best menstruum is water, and in this it is more soluble than the cinchonine.

Effects.—In its effects on the system, the dogwood resembles very nearly the Peruvian bark. This has been very fully established by the experiments of Dr. Walker. It has accordingly been used in this country as a substitute for the bark, and with complete success, acting not merely as a tonic, but as an antiperiodic remedy. Although resembling, however, the Peruvian bark, it is not to be compared to that article in general efficacy, and therefore is comparatively little used.

The fresh bark is apt to disturb the stomach and bowels. This is said to be corrected by keeping it about a year before it is used.

Mode of Administration.—In *substance* it is given in powder in doses of from ʒj to ʒij. The more common form is the *decoction.* This is prepared by boiling for ten minutes an ounce of the bruised bark in a pint of water, and straining while hot. Dose, ℥ij.

Besides the *Cornus Florida*, there are two other species, the *Cornus Circinata* and the *Cornus Sericea*, which possess properties analogous to the preceding.

Salix.—The *willow* is a most extensive genus of plants. Nuttall asserts the number of species to be a hundred and thirty. They are natives of Europe and the northern and temperate regions of North America. The

salix alba, or white willow, the one commonly used in medicine, has been introduced into this country from Europe, and grows very commonly. Its height is from twenty to thirty feet. It flowers in April and May. The part used is the *bark*.

As found in the shops, it is generally quilled and of a brownish color, fibrous in its texture, and not easily pulverized. It is destitute of smell, and has a bitter, astringent taste. According to analyses of Pelletier and Caventou, the willow bark contains *bitter yellow coloring matter*, *green fatty matter* (like that found in cinchona), *tannin*, *resinous extract*, *gum*, *wax*, *woody fibre, and a magnesian salt.*—(*Pereira.*)

The proportion of tannin which it contains is so great that it has been used for tanning leather. More recently the existence of a crystalline substance has been proved, which is called *Salicin.*

The willow bark yields its virtues to water.

Effects.—This article is analogous to cinchona in its operation. It is tonic and astringent, and capable of arresting intermittent fever. In every respect, however, it is inferior to cinchona.

It is given in substance and decoction, and in the same doses as the cinchona.

SALICIN.—This substance consists of white and slender crystals, with a bitter taste, but no smell. It contains no nitrogen, and does not form salts with acids; it is not a vegetable alkali. It is soluble in about twenty parts of cold water. In boiling water it is very soluble, as also in alcohol, but not so in ether or the essential oils.

Effects.—Analogous to the sulphate of quinine, but far inferior in power. In many cases of intermittent fever in which I tried it, it failed, and they were afterwards cured by the sulphate of quinine.

Dose.—From ten to thirty grains.

LIRIODENDRON TULIPIFERA.—This is one of the most magnificent of our forest trees, distinguished alike by its great height, its beautiful foliage, and superb flowers. It grows in almost every part of the United States, and not unfrequently attains the height of one hundred and thirty feet. Its flowers expand in the month of May, and are exceedingly beautiful, being variegated with yellow, orange, and green. It flourishes more particularly in the Western states. Its common name is the *Tulip tree*, or *the American tulip-bearing poplar*.

The part used in medicine is the *bark*, and this is taken from the root, trunk, and branches, though that from the *root* is considered the most efficient.

As found in the shops, it comes in pieces of various sizes, generally from five to six inches long, and two or three broad, of a rough and fibrous appearance, and of a whitish or clay color, very light and readily broken. It has a heavy, unpleasant smell, and a bitter, aromatic taste. It contains

gum, resin, iron, muriatic acid and mucus. By Professor Emmet, a peculiar principle, which he calls *Liriodendrine*, has also been discovered. This is a white crystallizable substance, not alkaline. It appears to hold a place like camphor between the resins and volatile oils.

The virtues of this bark are extracted both by water and alcohol. Long boiling impairs them.

Effects.—This substance is tonic, and at the same time stimulant and somewhat diaphoretic. It has been used as a substitute for Peruvian bark in intermittent fever.

The most efficacious form of giving it is in *substance* in the form of *powder*, ʒ ss to ʒ ij. The *infusion* (℥ j to pint of water) ℥ j to ℥ ij, and the *saturated tincture* (ʒ j) are also used, but are not so efficient.

Of the Liriodendrine no use has yet been made.

Piperin.—This substance was first discovered by Oersted in 1819. It is found in *black pepper, white pepper*, and *cubebs*. It is crystalline, perfectly white when pure, but as generally found in the shops of a yellow, straw color, without smell and almost insipid. It is not *alkaline*, as was at first supposed. In cold water it is insoluble, in boiling water slightly so, in alcohol and acetic acid perfectly soluble.

Effects.—Tonic, and used as a substitute for sulphate of quinine in intermittent fever; owing to its great insolubility, the best form of giving it is in pill. Dose grs. vi. to viii.

Prunus Virginiana.—This is the *Wild cherry tree*, a large and handsome tree growing abundantly in different parts of the United States, where it is indigenous. The part used in medicine is the *inner part* of the bark, obtained indiscriminately from all parts of the tree, though that of the *root* is the most active.

As found in the shops it comes in brittle pieces somewhat curved, of a cinnamon color, and generally destitute of epidermis. It has a bitter, aromatic taste, with the peculiar flavor of the bitter almond. When fresh or boiled in water it has the smell of peach leaves; it is easily pulverized—the powder is fawn-color.

This bark yields all its virtues to hot and cold water. It is supposed to contain *hydrocyanic acid*.

For medicinal purposes it should be used recently dried—long keeping impairs its virtues.

Effects.—This is a most valuable article. It is tonic in its operation, and from the prussic acid which it is supposed to contain, somewhat narcotic. If used in sufficient quantity it manifestly diminishes the frequency of the pulse. This gives it a peculiar advantage in all those cases in which you wish to allay irritability, and at the same time give tone. In dyspepsia, in the hectic of consumption, it is accordingly found very useful; used also in inflammatory fever, far inferior to cinchona.

Form. Powder.—ʒss to ʒi. The best form is the *infusion.* This is made by macerating half an ounce of the bruised bark in a pint of *cold* water for twelve hours, and then straining. The reason for using *cold water* is, that boiling water dissipates the volatile principle upon which its activity appears to depend.

Two or three ounces of this infusion may be taken three or four times a day, or ofteuer.

FERRUM.—Iron is a metal found in almost every part of the globe. It is of a bluish white color, and has a high degree of lustre; it is very ductile and malleable, with a specific gravity of 7·8. Of its chemical properties it is not necessary to speak at present.

Effects on the System.—As a general tonic iron may be ranked as perhaps the first on the list. In its action on the system it produces all the effects which have been described as characteristic of tonics. It improves the condition of the digestive organs, imparts tone to the muscular fibre, increases the action of the heart and blood-vessels, and quickens the various secretions. Besides these general effects as a tonic, there are some peculiarities attending the action of this agent which require to be noticed.

1. *The Permanency of its Operation.*—In this respect iron takes the lead of all other tonics. Whatever may be the cause, there is none which is capable of imparting such general vigor to the system, and none whose effects are equally permanent.

2. *Effects of Iron on the Blood.*—The effect of iron on the blood is peculiar; other tonics produce an improved condition of the blood, but they do it indirectly, and as a consequence of their influence especially on the digestive organs. Iron acts directly on the composition of the vital fluid itself. This is proved by analysis of the blood before and after the administration of iron. Simon gives a table of the results of such an examination made on the blood of a chlorotic girl, who in seven weeks took ten ounces of the tincture of iron and sixty-eight grains of metallic iron.

Before the use of the iron the blood contained in 1000 parts 871·5 water, 128·5 solid constituents, hæmatin 1·431. After the use of iron there were in 1000 parts, water 806·5, solid constitutents 193·5, hæmatin 4·598! Well may Simon say, "this change in the composition of the blood is *truly surprising!*" Here the amount of solid constituents is increased fifty per cent., and that of hæmatin more than 220 per cent.

[The change in the health of the patient kept pace with that of the blood. The results of the researches of Andral and Gavaret are identical with those of Simon. How very satisfactorily does this analysis explain the wonderful power of iron in cases of prostration from uterine hæmorrhage, and in all the forms of anæmia.—ED.]

Preparations of Iron. 1. *Limatura Ferri*—Iron filings. As the common filings obtained from the workshop are mixed with copper filings and other impurities, it is necessary to separate them. For this purpose, a sieve or piece of gauze is to be placed over them and the iron drawn through this by running a magnet over it. Even after this process the filings are not perfectly pure, and the only way to obtain them is by taking pure iron wire and filing it.

The oxidation of iron filings can be prevented by mixing them with an equal weight of pure dry sugar. The mixture must not be exposed to damp; but dry air will not oxidyze it. (Jour. de Phar.)

Effects.—In this form iron is in its metallic state, and, as such, like all other metals, exerts no action on the living system. To produce any effect, it must be oxidyzed, and therefore the filings can only operate as a tonic when they meet with an acid or some other substance in the stomach which will convert them into an oxide. Hence they are best suited to cases marked by the predominance of acidity in the digestive organs. The evidences of iron filings having taken effect, are fœtid eructations and the black color of the fæces. These are owing to the evolution of hydrogen gas, arising from the decomposition of water during the oxidation of the metal in the stomach and intestines.

Mode of Administration.—They may be given either in substance or pill—the dose from 5 to 20 grs.; in substance mixed in syrup, to which powdered ginger may be added. The common form, however, is that of pill, made with the bitter extract of gentian.

[*Iron reduced by Hydrogen.*—This preparation has been lately introduced by a French pharmacopist, M. Bouchardat. It seems to secure the two great desiderata—an impalpable powder and perfect purity. As such it is probably a valuable addition to our already very numerous list of chalybeates.—Ed.]

2. Oxides of Iron.—There are two oxides of this metal.

(*a.*) Protoxide.

(*b.*) Sesquioxide (peroxide).

(*a.*) *Protoxide.*—It consists of one equivalent of iron, 28; and one of oxygen = 36. Atom. No. This is the basis of the native carbonate o iron, and of the green vitriol of commerce. According to Turner, it has never probably been obtained in an isolated form. Beck says that it was first obtained by Stromeyer. In its separate form, therefore, it is not used.

(*b.*) *Sesquioxide of Iron.*—This is what is commonly known as the *red oxide* or *peroxide.* It is found native and prepared artificially. The *red hæmatite* is this oxide, and is an abundant natural production.

It is prepared by subjecting sulphate of iron in a crucible to an intense heat, until it is converted into a red substance. It is washed with boiling

water and dried. In this process, the protoxide of the sulphate is converted into the sesquioxide by the addition of oxygen which it obtains from the decomposition of a part of the sulphuric acid—the oxygen of which goes to the protoxide, while sulphurous acid gas is evolved. It consists of one equivalent of iron 28, and one and a half of oxygen, 12 = 40 atom. No. It is of a reddish *brown color*, tasteless, insoluble, and is not attracted by the magnet.

Effects.—This oxide produces the effects of iron on the system, though in a less degree than the other preparations. It is therefore not used by itself. In the state of *hydrate*, the sesquioxide has recently become very celebrated as an antidote to arsenic. This may be prepared by adding ammonia or potash or their carbonates to a solution either of pernitrate or persulphate of iron. The precipitate is to be washed with water and swallowed undried. (Pereira, vol. i. p. 396.) To be efficacious it must be taken in as large doses as the patient can swallow or the stomach retain.

Black Oxide—Oxidum Nigrum.—This is not a definite compound of iron and oxygen. It is a mixture of *protoxide* and *sesquioxide.* It occurs native in the form of the *magnetic iron ore.* It is prepared artificially by taking the small fragments or scales detached by hammering red hot iron. During this process these become oxidyzed. These scales are purified by passing the magnet over them and then reducing to powder. It is of a dark grey color, without taste or smell.

Effects.—This is one of the best preparations of iron and dissolves very readily in the stomach (much more so than the sesquioxide), and produces the ordinary effects of this metal.

Dose.—From 5 to 20 grs. two or three times a day.

[As the strength of this preparation is very apt to vary with the varying proportions of protoxide and sesquioxide, the Edinburgh College has ordered a preparation in which the two oxides are united (for this is a true chemical union and not a mere mechanical mixture) in equal proportions. This is equal in its powers and not liable to alter by exposure to air. (Vide Christison, p. 482.)—Ed.]

3. Carbonate of Iron.—There are two modes of preparing this salt.

(*a.*) By exposing iron wire cut into small pieces to the action of air and water, until it is converted into rust. It is then to be reduced to powder in an iron mortar. In this process the iron is oxidyzed by the oxygen of the water, which is decomposed, while carbonic acid is attracted from the atmosphere. When prepared in this way, it is known by the name of the *carbonas ferri preparatus* or the *rubigo ferri.*

(*b.*) Another mode is by the joint action upon each other of solutions of *sulphate of iron* and *carbonate of soda.* A double decomposition takes place. The *sulphate of soda* remains in solution, and the hydrated *carbonate of iron*, being insoluble, is precipitated. The supernatant liquid is

then poured off and the precipitate dried on filtering paper with a moderate heat. When prepared in this way, it is called the *carbonas ferri precipitatus.*

As found in the shops this preparation of iron is of a chocolate brown color, without smell, with a slightly styptic taste. It is insoluble in water. Acids dissolve it and extricate the carbonic acid gas with effervescence.

Although so called, this preparation is not a carbonate of iron. According to the analysis of Mr. Phillips, it is a compound consisting of variable proportions of the *peroxide of iron* and the *protocarbonate of iron.* As commonly found in the shops, Mr. Phillips states the proportions to be about,

Carbonate of Iron, ...	4
Peroxide of iron, ...	96
	100

and when prepared with the greatest care

Carbonate of iron, ...	40
Peroxide of iron, ...	60
	100

The *rationale* of all this is the following:—When prepared by precipitation, as already stated, a *hydrated protocarbonate* of iron is thrown down of a green color. During the process of drying, this precipitate is changed in its character. From the great affinity of iron for oxygen, the protoxide is rapidly converted into the *peroxide*, in which latter state it is no longer capable of holding the carbonic acid in combination. A large portion is thus converted into the peroxide. A portion, however, remains undecomposed, and this varies according as the drying is slowly or rapidly conducted.

The activity and efficacy of this preparation depend upon the quantity of carbonic acid held in combination.

Effects.—Although not a pure carbonate, this is a valuable preparation of iron. It is mild yet efficacious, and it may be given in large quantities without any unpleasant consequences. The ordinary dose is from ten to thirty grains three times a day. To obtain the full effect of it, however, it is necessary frequently to give it in doses of one, two, and three drachms.

From the great propensity which the carbonate in its solid state has to become changed in its character, it is necessary, if you wish to give it in its pure state, to administer it in one of the following forms:

(*a.*) *Mistura Ferri Composita.*—This is prepared by rubbing up myrrh, carbonate of potassa, sulphate of iron, rose water, spirit of lavender, and sugar. The mixture is to be poured immediately into a glass bottle and well stopped. This is an imitation of Dr. Griffith's myrrh mixture. In this preparation the sulphate of iron is decomposed, and a sulphate of

potassa and a protocarbonate of iron formed. The mixture at first is of a greenish color; if exposed to the air it loses this, in consequence of the protoxide being converted into the peroxide, in which case the protocarbonate is decomposed. To preserve it, therefore, the bottle should be well stopped, or what is better, it should only be prepared when required for use. Dose one to two fluid ounces two or three times a day—a valuable preparation.

(*b.*) *Pill. Ferri Compositæ.*—These are made by rubbing up myrrh, sulphate of iron, carbonate of soda, and syrup, and made into pills.

Here the same changes take place. The sulphate of soda and the protocarbonate of iron are formed. They should only be made when required for use. Dose from ten to twenty grains.

(*c.*) *Saccharine Carbonate of Iron.*—Recently it has been ascertained that if the proto-carbonate, when first precipitated, and before drying, be mixed with syrup or sugar, it will be retained in its original state without undergoing any change.

This is an exceedingly valuable discovery, and gives us a most excellent and reliable chalybeate.

4. *Proto-Sulphas Ferri.*—This is known by the names of *Vitriol of Mars*, *green vitriol*, *copperas*, and *Sal Martis*. It is prepared by the action of sulphuric acid upon iron. It is crystalline, with a disagreeable, styptic taste; its color, when recently formed, is bluish green. It is soluble in about two parts of cold and in three fourths of its own weight of boiling water; in alcohol it is insoluble. When exposed to the atmosphere it not merely effervesces, but undergoes other chemical changes—oxygen is absorbed from the atmosphere.

Effects.—This is one of the most active of the preparations of iron, being powerfully tonic and astringent. If given in too large doses it acts as a local irritant to the stomach and bowels, causing nausea, griping, vomiting, and purging. Although a valuable form of this metal, it cannot be given with the same freedom as some of the other preparations; nor is it so well suited to those cases where the long-continued use of ferruginous preparations is required.

Mode of Administration.—The dose is from one to five grains, and the best form of giving it is that of pill made up with myrrh, ammoniac, or some of the bitter extracts. Solution is an objectionable form, unless the water be previously boiled to expel the atmospheric air from it. If this is not done oxygen is absorbed and the sulphate is decomposed.

5. *Ferrocyanas Ferri*, also called the *Prussias ferri*, or prussiate of iron. This is the principal ingredient in the common pigment called *Prussian blue;* and it is in this latter form that it is used in medicine.

Prussian blue as found in the shops is in cakes of a deep blue color, without taste or smell. It is insoluble both in alcohol and in water.

It is a compound of the ferrocyanate of the peroxide of iron and of alumina.

Effects on the System.—Prussian blue is a mild, though efficacious preparation of iron. It sits easy on the stomach, seldom producing any nausea or local irritation. In its general operation as a tonic it appears to act with more promptness than the other preparations of iron.

Mode of Administration.—A good way of giving it is in powder, in a cup of milk, in doses of from three to six grains, repeated about three times a day.

6. PROTO-PHOSPHAS FERRI.—This is prepared by the joint action of solutions of sulphate of iron and phosphate of soda—a double decomposition takes place, the phosphate of iron being precipitated, while the sulphate of soda is held in solution.

It is a powder of a pale blue color, and without taste or smell.

Effects on the System.—It is a mild preparation, analogous in its operation to the other forms in which iron is given.

Mode of Administration.—It is given in doses of from eight to ten grains, three times a day.

7. TARTRAS FERRI ET POTASSÆ.—Also called *Ferrum Tartarizatum*, or *Tartarized Iron.* This salt is prepared by the joint action of iron and supertartrate of potassa with water. Here the iron is first oxidyzed by the oxygen of the water and the atmosphere, and afterwards dissolved by the excess of acid of the supertartrate of potassa. A double salt is thus formed, consisting of the tartrate of iron and potassa.

As found in the shops, this preparation of iron is a powder of a greenish brown color, without smell, and has very little of the disagreeable taste of iron. It is readily soluble in water; on exposure to the atmosphere it becomes moist. Hence, it is necessary to keep it in closely stopped bottles.

Effects on the System.—As a ferruginous preparation this has many advantages. From its want of taste and its easy solubility, it is one of the best forms for giving this metal to children. It is less constipating and less exciting, too, than some of the other forms of this metal.

[This is the Chalybeate most used by Ricord in sloughing chancres, intractable sores in broken constitutions, &c., &c.—ED.]

Mode of Administration.—The dose is from ten to thirty grains, and may be given in bolus or solution. The solution will keep a considerable length of time without decomposition.*

8. FERRUM AMMONIATUM.—This is prepared by the action of muriatic

* "Occasionally, it deposits tartrate of lime, this being an accidental impurity in the supertartrate of potash."—Phillips, p. 106.

acid upon the carbonate of iron—a muriate of iron is thus formed. This when dried is mixed with the muriate of ammonia and sublimed. It is, therefore, a mixture of muriate of ammonia and permuriate of iron.

As found in the shops, this is in yellow crystalline grains, with a slight odor, and a saline, styptic taste. It is very soluble and deliquescent.

Effects on the System.—From the variable and small quantity of iron which this preparation contains, it is feeble and uncertain in its operation as a tonic. On this account it is not much used at present. Unlike some of the other ferruginous preparations it is slightly aperient.

Mode of Administration.—It may be given in doses of from grs. x to xv, three times a day.

10. Tinctura Ferri Muriatis.—The *muriated tincture of iron.* This is prepared by dissolving the carbonate of iron of the shops in muriatic acid, and then adding rectified spirits to the clear liquor. As already stated, the subcarbonate of iron consists of a mixture of peroxide of iron and the carbonate of the protoxide of iron. By the action of muriatic acid, a protochloride and a perchloride of iron are formed. By the action of muriatic acid on the alcohol a little muriatic ether is also formed. This preparation, therefore, consists of protochloride of iron, perchloride of iron, muriatic ether, and alcohol.

As found in the shops, this tincture is of a reddish brown color, with a styptic, astringent taste, and a smell somewhat resembling ether.

Effects.—This is one of the most certain and active of the preparations of iron. If given in moderate quantities it sits well on the stomach. In large doses it acts as a local irritant to the digestive organs.

Mode of Administration.—It is given in doses of from ten to thirty drops in a cup of water, to be repeated three or four times a day.

Lactate of Iron.—This is obtained by the direct action of a dilute solution of lactic acid on iron filings. This is digested by a gentle heat for six or seven hours; after this the liquid is boiled, filtered, and concentrated until crystals are formed on cooling.

This salt, which is the lactate of the protoxide of iron, is generally met with in the form of a yellowish or greenish white powder, sometimes as greenish acicular crystals. But little soluble in water, reddens litmus paper, and has a ferruginous taste. When dissolved in water the iron passes to a higher state of oxidation, and the salt becomes yellow. This salt is highly commended by some of the French physicians, and thought by them to be superior to all other. This is denied by Miahle and Pereira.

It may be given in pastilles or lozenges—the sugar preventing the further oxidation of the iron.

Dose.—Four to ten grains, three or four times a day.

Citrate of Iron.—This preparation was first introduced in 1831 by M. Beral, of Paris. It is prepared by taking a boiling solution of crystallized citric acid in water and saturating it with the moist hydrated peroxide of iron. When cold the solution is to be filtered, and when spread upon glass speedily dries and separates itself from the glass in thin lamina.

This salt is uncrystallizable, strongly reddens litmus paper, and has an acid but not unpleasant taste. It is very slowly soluble in cold water. In boiling water it is readily soluble. Its pleasant taste has commended it to the use of some practitioners, but it is not much used.

Dose—5 to 10 grs. three times a day.

Ammoniated Citrate of Iron.—This is prepared by adding to the acid citrate of iron in solution (as above described) ammonia, so as to neutralize the acid. A double salt is thus obtained of a neutral character, and which dissolves much more readily in cold water than the citrate.

[This chalybeate is highly commended by G. Bird as a tonic, in urinary disease (lithuria). He found this and the ammoniated tartrate, to suit the stomach better than any other preparations of iron. *Dose*—5 grs. three times a day.—Ed.]

Ferro-Tartrate of Ammonia.—May be prepared by adding caustic ammonia to a solution of tartrate of iron. The green solution thus obtained is to be evaporated to dryness.

In the form of shining brittle fragments of a deep red color, very soluble in water, and strongly saccharine in its taste. Acts like other ferruginous preparations. Its advantages are:

1. Great solubility.
2. Palatable taste.
3. Not readily decomposed.

Dose.—For an adult 5 to 6 grs. in powder, pill, or solution; may be taken in porter without any taste.

Argentum.—Silver is found either pure, in combination with other metals, such as gold, mercury, arsenic, and antimony, or in the state of sulphuret, either pure or mixed with the sulphurets of copper, lead, and antimony. The principal mines from which it is obtained are those of Mexico and Peru, and in Europe those of Hungary and Transylvania. The mode of extracting silver from the ore (sulphuret, etc.) is the following: It is first mixed with common salt (chloride of sodium) and roasted in a reverberatory furnace. Here the sulphur becomes converted into sulphuric acid and the sodium into soda, forming sulphate of soda, while the chlorine unites with the silver, forming chloride of silver. The mass then consists of sulphate of soda and chloride of silver. This is then reduced to a very fine

powder and mixed with certain proportions of mercury, water, and iron in flat pieces, and subjected for several hours to agitation in barrels turned by machinery. During this process the chlorine combines with the iron and remains in solution, while the silver forms an amalgam with the mercury. The amalgam is then subjected to pressure in leathern bags, through the pores of which the excess of mercury passes and a solid amalgam is left behind. This is then subjected to the action of heat, the mercury is volatilized, and silver left behind. [U. S. Disp.]

Properties.—Silver is of a pure white color, and susceptible of receiving a lustre surpassed only by polished steel; without smell or taste. In malleability and ductility it is inferior only to gold; when pure it is so soft as to be cut with a knife; at a red heat it fuses. Its specific gravity is 10·5. The only pure acids that act upon silver are the sulphuric and nitric. The sulphuric, however, only acts upon it with the aid of heat. The silver of the shops generally contains traces of gold and copper.

Preparations of Silver.—In its metallic state silver is not supposed to exert any agency upon the human system. The preparation of it which has been most generally used is the *nitrate.* Very recently the *oxide* has also been introduced into practice.

NITRATE OF SILVER.—*Lapis Infernalis, Lunar Caustic.*—This is prepared by taking an ounce and a half of silver and dissolving it in a mixture of one ounce of nitric acid and two ounces of distilled water. This forms a solution which by evaporation yields crystals. By subjecting these crystals to a suitable heat, they become fused, and in this state are cast into small sticks in circular moulds prepared for that purpose.

During this process a portion of the nitric acid is decomposed into nitric oxide gas and oxygen. The nitric oxide escapes, and by union with the oxygen of the atmosphere forms red nitrous acid vapors, while the oxygen unites with the silver to form oxide of silver. With this the remaining undecomposed nitric acid unites and forms the *nitrate of silver.*

When pure the crystals of nitrate of silver are transparent and colorless. In the form of stick, the pure nitrate is of a white color, with a taste metallic and bitter; breaks with crystalline fracture. On exposure to the atmosphere, it does not deliquesce. When subjected to the action of *heat,* it fuses; if the heat be increased it is decomposed, nitric acid and oxygen are evolved, and metallic silver left. When exposed to a *strong light,* it becomes blackish, especially if in contact with any carbonaceous matter. This is owing to the reduction of a part of the silver to a metallic state. (Phillips.) It is soluble in alcohol and in water.

Purity.—To be perfectly good it should possess the following properties:

1. The stick *should be of a white color;* when colored it shows some

impurity; when the color is blackish it has been "contaminated with organic substances, or formed by moulding in iron vessels;" when the color is very pale it may be owing to the presence of reduced silver, or a small quantity of copper."—Domestic Chemist.

2. The *fracture* should be *crystalline* and *radiated;* when the fracture is conchoidal it is impure.

3. It should be *completely soluble in distilled water;* any deposit that forms from the solution shows an impurity.

4. The solution, when tested with ammonia, should throw down an abundant precipitate (the oxide of silver), which should be entirely redissolved on adding an excess of ammonia. The solution should then remain colorless—the least tinge of blue indicates the presence of *copper.*

The substances which may be deposited by impure lunar caustic during its solution, are *oxide of copper*, *reduced silver*, and *chloride of silver.* On separating these deposits from the solution, their character may be ascertained in the following way:

1. If the "deposit" dissolves easily in nitric acid without producing red fumes, and gives a solution which becomes blue when tested with ammonia, it is *oxide of copper.*

2. If it dissolves slowly in nitric acid under the production of red fumes, and forms a solution which does not become blue with ammonia, it contains *reduced silver.* In this case the sticks of lunar caustic possess a corroded appearance, and seem to contain air bubbles.

3. If it is insoluble in nitric acid, but easily soluble in ammonia, or if it readily becomes black in the light, it is *chloride of silver.*—Domestic Chemist, p. 232.

The foregoing are impurities arising during the manufacture of the article, owing to impurities in the silver, and in the nitric acid.—See U. S. Disp.

Sometimes, however, it is fraudulently adulterated, and chiefly with *nitre* and nitrate of lead. The way to ascertain this is as follows:

1. If on adding ammonia to a solution of it only a *slight* precipitate take place, the adulteration may be suspected.

2. To a solution add hydrochloric acid, until no more of the precipitate take place. This throws down all the silver in the form of chloride of silver. Then separate the solution from the precipitate by filtration; evaporate it to dryness. If a residue remain, throw it on burning coals, and if it deflagrates it proves the presence of nitre.

Effects on the System.—The most interesting and important of these are the effects which it produces when used as a local application. Of these we shall speak under another head. When taken internally its primary local effect varies with the dose; if given in considerable quantities it acts as a local irritant, producing heat about the fauces, nausea, and griping, succeeded by actual vomiting and purging; if this quantity, however, be

small no sensible effect of this kind is produced, and the impression which it makes on the nerves of the stomach is soothing and tonic. This is particularly illustrated in irritable states of the gastric organ. Besides the local effect thus produced on the stomach, an analogous effect is extended to the brain and whole nervous system. What the precise nature of this impression is it is not easy to say, and we can judge of it only as we see it exemplified in the correction of certain morbid conditions of the system. Thus, for example, this article has been found to cure epilepsy, and we presume that it does so by a certain impression which it makes upon the nervous system, and this we generally designate as a tonic impression. The effect of nitrate of silver, however, is peculiar, and different from ordinary tonics.

In connexion with the operation of this article on the system, there is another peculiarity which requires to be noticed, and this is the effect which it sometimes produces of discoloring the skin and other soft solids. This was incidentally noticed early in the course, when speaking of the absorption of medicines.

The diseases in which nitrate of silver has been most given are epilepsy, chorea, and some forms of dyspepsia. What its modus curandi is in epilepsy and chorea, we know not. It appears to produce the best effects in those cases of dyspepsia where there is evidence of morbid sensibility of the gastric nerves.

Oxide of Silver.—This is obtained by adding lime water or pure baryta to a solution of nitrate of silver, then washing and drying the precipitate. Here the nitric acid unites with the lime or baryta, while the oxide of silver is precipitated. In the state of hydrate, it is of a black color; when anhydrous, it is of an olive color, tasteless, and insoluble in water.

Effects.—Oxide of silver is a much less active agent than nitrate. It has little of its caustic or irritating power, and, perhaps, because it less readily forms soluble compounds in the stomach, is less apt to produce irritation there. It is not so prone to discolor the skin, probably being less active both for good and evil. It is used in the same cases as the nitrate.

It has been found useful in uterine diseases, especially in uterine neuralgia (irritable uterus), and in some of the forms of leucorrhœa and dysmenorrhœa.

Dose.—One to two grains, three times a day in pill or powder.

Arsenic.—In the form of some of its combinations, this metal was known to the ancients. By Dioscorides the sulphuret of arsenic is noticed. The peculiar nature of the metal was first shown, however, by Brandt in 1733.—(Beck.)

It is an exceedingly brittle metal of a steel grey color, and when recently broken has a strong metallic lustre. Its texture is crystalline, destitute of

taste—at 356° F. it volatilizes without being fused, and gives out a garlic odor. By exposure to the air it is speedily tarnished and converted into a black powder, which is called *fly powder.* This is a mixture of the metal and the oxide.—Sp. gr. 7. 5.

In its metallic state arsenic is sometimes found native—most commonly, however, it is found in combination with other metals, such as cobalt and iron. It is not used in medicine.

With oxygen it forms two compounds, *arsenious acid* and *arsenic acid.* The first is the only one used in medicine.

Arsenious Acid.—Commonly called the *oxide of arsenic.* This substance when first prepared is in large masses, having a vitreous fracture and perfectly transparent. After a while it becomes white and opaque, this change taking place gradually from the surface to the centre. Its specific gravity is 3·7. It has no smell, not even in a state of vapor, as the garlic odor belongs only to metallic arsenic; it has little or no taste; it is very sparingly soluble in cold water, more so in hot. In alcohol and oils it is soluble—at 380° it volatilizes, and the vapors condense unchanged on cold surfaces in the form of crystals.

Purity.—As commonly found in the shops it is in powder. In this state it is apt to be mixed with flour, powdered chalk, or sulphate of lime. This may be detected by putting some of it on the point of a knife and subjecting it to heat. The arsenious acid will be dissipated, while the impurities will remain behind.

Preparation.—This article is prepared chiefly in Bohemia and Saxony, where it is obtained during the smelting of cobalt ores, which generally contain metallic arsenic in combination. During the combustion the arsenic is converted into arsenious acid, is sublimed, and condenses in large masses on the side of the flues. To purify it, it is resublimed. It is then broken into suitable pieces and packed in casks.

Physiological Effects.—When given in *small and repeated doses,* arsenic acts on the system without producing any visible effect, except in the alleviation of the disease for which it may be administered. By some it is supposed to produce the effects of a tonic, and accordingly by most writers on the Materia Medica it is ranged under the class of tonics. This opinion has been drawn, I suspect, rather from its power of arresting the paroxysms of intermittent fever, than from any obvious effect upon the system. That it does in some cases produce a tonic effect is unquestionable. This arises, however, rather from its salutary operation in counteracting diseases, than from its direct action on the system. At any rate, we should never think of giving it as pure tonic like quinine or iron. On the secretions the only well-marked effect of arsenic is to increase the quantity of urine.

If the use of the arsenic be persisted in for a certain length of time symptoms of a peculiar character begin to develope themselves. The digestive organs become more or less disordered, nausea, loss of appetite, pain in the stomach and bowels, accompanied sometimes with vomiting, purging, and a general febrile excitement of the system take place, the tongue is dry and furred, and the pulse becomes small and frequent, the limbs lose their power, and finally become paralysed; the face swells, and is sometimes covered with an erythematic eruption extending frequently to other parts of the body. In many cases there is heat in the fauces, tenderness of the gums, and actual salivation. When these symptoms show themselves it is an evidence that the system is under the full influence of the article, and it should be immediately stopped. If persisted in, it acts as a poison and destroys life.

Modes of Administration. (*a.*) *Substance.*—It is sometimes used in this form made into pills in doses of from $\frac{1}{16}$ to $\frac{1}{10}$ of a grain. The pills should be prepared with great care. For this purpose the arsenic should be intimately rubbed up with white sugar, and then made up with crumbs of bread.

(*b.*) *Solution.*—The common form in which it is used in solution is the *liquor arsenicalis*, or the *liquor potassæ arsenitis*, commonly called *Fowler's solution*, from the person with whom it originated.

This is prepared by taking of arsenious acid, finely pulverized, sixty-four grains, and boiling it in a solution of sixty-four grains of carbonate of potassa in a pint of distilled water, until the arsenic is completely dissolved. To the solution, when cold, add four fluid drachms of compound spirit of lavender, and then as much distilled water as will make the whole solution up to a pint.

In this preparation the arsenious acid combines with the potassa, while the carbonic acid escapes. It is, therefore, a solution of the arseniate of potassa colored by the spirit of lavender. It is a transparent liquid, having the taste, smell, and color of the lavender. Each fluid drachm of this solution contains half a grain of the arsenious acid.

The average dose is ten drops two or three times a day for an adult.

Dr. Fountain objects to this mode of giving Fowler's solution. He says that given in this way it has to be continued for some time, and it then is apt to accumulate in the system, and produce unpleasant effects. He gives it in doses of ten drops every two hours (in intermittent fever), so as to give 60 or 100 drops during a single intermission, and then stops with it altogether. In this way he has used it, he says, in a great number of cases, and never witnessed any bad effects from it.

(*c*) *Arseniate of Soda.*—This is given in solution:

℞. Arseniatis sodæ grs. iv.
Aquæ distillat. ℥ iv. M.

This is a preparation used by Biett in the Hospital of St. Louis, at Paris,

as a substitute for Fowler's solution. Each drachm of this contains one eighth of a grain of the salt. From twenty to thirty drops is a dose.

(*d.*) *Arseniate of Ammonia.*—This is also used in solution:

℞. Arseniatis ammoniæ grs. iv.
Aq. dist. . . ℥iv. M.

This is also used by Biett in the same way as the preceding.

Zincum.—1. *Oxide of Zinc.*—This is commonly known by the name of the *flowers of zinc.* There are two ways in which this may be prepared: (*a.*) By the combustion of metallic zinc in a crucible. During this process it unites with the oxygen of the atmosphere and is sublimed. (*b.*) By adding water of ammonia to a solution of sulphate of zinc a precipitate is thrown down, which is to be separated and dried. Here the sulphuric acid unites with the ammonia, and is held in solution, while the oxide of zinc is precipitated.

This substance is a white powder, without taste or smell. It is insoluble both in water and in alcohol.

Effects.—The oxide of zinc possesses tonic properties, but its powers in this way are comparatively feeble. As a remedy in epilepsy and other spasmodic diseases, it was first introduced into practice by the celebrated Gaubius, and from the high authority from which it emanated, gained considerable celebrity, which however it has not since maintained.

Mode of Administration.—The best form of giving it is that of pill made up with confection of red roses, in doses of one or two grains, and gradually increased. To young subjects it may be given simply triturated with white sugar. By Dr. Horne it is stated that he frequently observed that when it proved curative, it was in doses of grs. ii or grs. iij, and that when such doses failed, larger ones of forty grains never succeeded.

2. *Sulphas Zinci.*—Although not in common use this is a good tonic, and may be used in doses of one fourth of a grain, gradually increased to grs. ij, repeated two or three times a day.

Copper.—There are only two preparations of this metal used in medicine.

1. *Sulphate of Copper.*—This salt has already been described under the head of emetics. When given in small doses it acts without producing any sensible local effect, as a general tonic. This is proved by the fact that it is capable of arresting the paroxysms of intermittent fever. By Dr. Donald Monro it was prescribed in 1785, in some cases of this disease with success, after the Peruvian bark and other medicines had been administered without any benefit.

Mode of Administration.—It may be given in doses of from one fourth of a grain to one or two grains made into pill with extract of cinchona, to be repeated three or four times a day.

2. *Cuprum Ammoniatum.*—This salt is prepared by rubbing up sulphate of copper with carbonate of ammonia, until the effervescence ceases. It is then to be wrapped in bibulous paper and dried with a gentle heat. A double decomposition here takes place. Part of the sulphuric acid goes to the ammonia, forming a sulphate of ammonia, while the carbonic acid escapes with effervescence, and the copper remains in a state of subsulphate. The compound therefore appears to be a mixture of subsulphate of copper and sulphate of ammonia.

As found in the shops this substance is a violet-colored mass, with an ammoniacal smell and a styptic and metallic taste. On exposure to the atmosphere, its color changes to green, owing to the escape of ammonia. It is soluble in water.

Effects.—As a tonic this substance operates in a manner similar to the sulphate of copper. It is milder, however, and therefore may be given in considerably larger doses. Its use originated with Dr. Cullen.

Mode of Administration.—The best form is that of pill made up with bread, in doses of half a grain gradually increased to five grains, two or three times a day.

Nitric Acid.—This acid is obtained by decomposing nitrate of potassa by means of sulphuric acid, which has a stronger affinity for potassa than the nitric acid.

Nitric acid is a colorless or pale yellow fluid, emitting, when exposed to the air, white suffocating vapors and possessing strong acid properties. It is highly corrosive and tinges the skin yellow, the tint remaining till the epidermis is separated. When exposed to the air it attracts moisture and becomes weaker. It unites with water in every proportion, and while mixing heat is evolved. In its pure state it is seldom employed except for pharmaceutical purposes. The diluted acid is made by the addition of nine times the quantity of water.

In its effects upon the system nitric acid acts as a general and efficient tonic. It is particularly valuable when the constitution has been broken down during a long protracted course of mercurial remedies. In these cases it not merely promotes the general health, but it also lessens the mercurial action upon the mouth and fauces. In chronic hepatitis and dropsy, consequent upon a shattered constitution, it has been found eminently serviceable.

Besides its effects as a general tonic, the nitric acid produces a peculiar taste in the mouth, and when carried to a certain extent sometimes brings on salivation, and at the same time acts moderately on the bowels.

Its dose is from 20 to 30 drops, given in iij ℥ or iv ℥ of water three or four times a day.

Besides being given internally, it has been much used in India in the form of a bath in combination with muriatic acid. This is made by taking

two parts of muriatic and one of nitric acid, and adding water until the whole is about as sour as vinegar. When the feet are put in this bath it is remarkable that it produces the same effects that it does when taken internally, and in addition to this causes a peculiar excitement and irritation of the skin.

The nitro-muriatic acid bath is used chiefly in syphilitic cutaneous diseases and in hepatic affections. It was formerly very popular, but hardly retains its reputation.

ASTRINGENTS.

The term Astringent is derived from the Latin (*astringo*), and literally signifies to bind together. As used in medicine it is applied to a class of agents which possess the power of corrugating the animal fibre. Hence they have been defined to be those substances which, "when applied to the human body, produce contraction and condensation in the soft solids, and therefore increase their density and force of cohesion." This definition is imperfect only so far as it does not include in it any recognition of the general tonic influence which most of these agents exert over the system.

The *local* effects of astringents are obvious. When applied externally to bleeding vessels, they contract the vessels and arrest the bleeding; when thus used they are commonly called *styptics*; when taken into the mouth they have a peculiar and rough taste, and produce a sense of constriction in the parts with which they come in contact. As a consequence of this constriction the small vessels circulate less blood, the secretions of the mouth and fauces are lessened, and the general sensibility of these parts to other impressions temporarily is impaired. When swallowed we infer that analogous effects are produced upon the mucous membrane of the œsophagus, stomach, and intestines with which they come in contact. At the same time that they act upon these parts by constringing them and lessening expectoration and secretion, they also affect their vital properties, by imparting tone to them. This at least is the case with a great proportion of them. Accordingly, if given in moderate doses like tonics, they promote the appetite and assist digestion. If, on the other hand, they be given in very large doses, they disorder the functions of digestion, cause pain, and not unfrequently produce nausea and vomiting.

The *remote* effects of astringents are similar in character, although less in degree than the local effects. Various portions of the mucous tissue, though not locally acted on, nevertheless participate in the effects of these agents. This is particularly the case with the mucous membrane lining the pulmonary and urinary organs, and under the continued use of astringents exhalation and secretion are diminished from these parts.

The *skin* is strikingly affected in a similar way. In the ordinary condition of the system it becomes, under the use of astringents, dry and contracted; and if excessive evacuations take place they are restrained.

On the *muscular* system the effect of astringents is analogous to that of

the pure tonics. From the direct impressions made by them upon the mucous membrane of the stomach and bowels, the muscular tissue of these organs is most particularly acted on. The effect, however, does not stop here. The muscular fibre of the heart and arteries, and indeed of every other part of the system, participates more or less in the same impression.

On the *vascular system* the effects of astringents are striking and important. In consequence of the contraction which they produce in the small vessels of the part to which they are applied, together with the impaired secretion which they occasion, the blood is accumulated in the larger trunks. If this be continued for any length of time, the heart and blood-vessels become crowded with this fluid. Reaction now takes place. The pulse is full and hard, general plethora ensues, and as remote consequences, local congestions and hæmorrhages may take place.

On the *brain and nervous system* astringents produce no direct effect, except from the properties which they possess in common with tonics. In this way they increase the energy of the nervous system. Indirectly, however, as pure astringents they may exert a powerful agency on this part of the system. By checking the secretions they produce general plethora and local determination to the brain, which not unfrequently is followed by cerebral congestion and paralysis.

With regard to the manner in which the remote effects of astringents are brought about, whether by the actual introduction of these agents into the circulation, or by the mere transmission of the local impressions, it is impossible to say. In some cases, doubtless, it may be in the first of these modes; in the majority, it is probably in the latter. Be this as it may, that various parts of the animal economy are thus more or less influenced is certain.

From the preceding analysis of the effects of astringents, it is very evident that they cannot be used with safety or advantage in every state of the system. Hence, it is important to specify:

1. They ought not to be used where a general plethora exists. In such a state, if by the use of astringents the ordinary secretions be checked, the general fulness of the blood-vessels must be increased, and apoplexy or some analogous effect may be produced. So, also, when a discharge is taking place from the system in a full habit, such as diarrhœa or hemorrhoids, or the like; if this be arrested by the use of astringents, the consequence must be injurious, and sometimes fatal. In these cases nature is endeavoring to relieve herself from over-fulness by some critical evacuation, and any interference with this must be hazardous.

2. They ought not to be prescribed where febrile or inflammatory excitement is present. In fevers and inflammations one of the great objects is to relax the whole system of capillary vessels, or in other words, to promote all the secretions, and generally just in proportion as this object is accomplished will the excitement be lessened. On the contrary, astringents

checking the secretions necessarily increase the existing excitement, and frequently cause local obstructions.

3. They ought not to be prescribed where excessive secretion depends upon, or is associated with, active irritation either local or general. To this rule exceptions, however, exist, which will be mentioned hereafter.

4. They ought not, as a general rule, to be prescribed where there is much disorder of the digestive organs, as indicated by furred tongue, defective secretion of bile, costive bowels, &c. In all cases this should first be corrected by appropriate remedies. Otherwise, not merely will astringents fail in producing their intended effect, but the disorder of the digestive organs will be aggravated.

There are various modes in which astringents may be made to act on the system:

1. By applying them directly to the part which it is desired to constringe. In this way they may be used as injections to many parts of the system, as the eye, the ear, the fauces, the urethra, the rectum, &c. When this can be done, it is the most efficient mode of producing the intended effect.

2. By taking them into the stomach. In this way they act not merely on the parts to which they are immediately applied, but they extend their influence to distant parts.

3. By applying them to the skin—cold applied either to the whole surface in the shape of cold baths, or local applications of cold water and ice, extends its astringent influence to the internal parts of the body.

4. By injections into the rectum. In this way they not merely affect the rectum itself, but extend their influence to other parts. Hence, in uterine hemorrhage, one of the most efficient agents is the injection of cold water into the rectum.

[The quantity should be large.—Ed.]

Therapeutic Applications.—I come now to make some observations in relation to the practical application of astringents in the treatment of diseases.

From what has been already stated concerning the effects of these agents upon the system, it is evident that their therapeutical agency must be mainly limited to the accomplishment of two objects:

1. To the restraining of excessive evacuations from the system, whether in the form of blood or various *secreted fluids.*

2. To the producing contractions of relaxed animal fibre, and thus imparting tone. It is with a view to these effects that they are used in various diseases.

For the purpose of illustrating this more fully I shall go a little into detail.

1. *Of those affections which are characterized by increased secretions of various kinds.*—These secretions take place from different textures and

different organs, and the effects of astringents will of course differ accordingly. Over the secretions from some textures they exercise a very marked control, while over those from others they exert very little.

2. *Of Mucous Membranes.*—This membrane throughout its whole extent is liable to discharges, constituting a very large and exceedingly troublesome set of affections. They result from different causes; in some cases from actual inflammation, leaving the membrane in a relaxed and debilitated state, while in others they occur without inflammation from irritating and enfeebling causes. In both cases the effect is the same—an increased discharge from the part. Now, in these cases, *astringents* are remedies which are continually resorted to. From what has already been stated in relation to the effects of these agents, it is very evident that unless used with great discretion, they will not merely fail of producing their intended effect, but will be positively injurious. As a general rule, the only condition of the system, and of the part affected, in which they can be used with safety and advantage, is that in which the discharge is of a purely passive character, or in other words, where all local inflammation and general excitement have been previously subdued. If used antecedently to this their necessary effect must be to augment the distension of the vessels concerned, and thus aggravate the inflammation.

[This is the general rule, and may, with very slight variations, be applied to all the different mucous membranes, and thus guide us in the use of collyria, of gargles, of injections, and of astringents taken into the stomach to control excessive discharges from the alimentary canal. In all these cases, if the astringent is used while yet acute or sub-acute inflammation is present, it is sure to do harm. It is only when this has been subdued, and when a passive congestion or a mere relaxation of the membrane is present, that astringents are proper. No one now doubts but that leucorrhœa gained its character of a most intractable disease mainly from the indiscriminate use, or rather *abuse*, of astringent vaginal injections.—Ed.]

2. The second form of excessive evacuation, to restrain which we use astringents, is hæmorrhage. These discharges, whether from the lungs, the bowels, or the uterus, are all more or less under the influence of astringents judiciously applied. To get, however, a good effect from them they must be used with due regard to the cause of the discharge and the state of the system. As a general rule it is just in proportion as the hemorrhage is more or less markedly passive that a good effect may be expected from astringents.

The other class of affections in which astringents are used is where the object is to produce a constringing and then a tonic impression on the relaxed parts. The good effect of astringents in passive diarrhœa is to be explained in this way. The surgeons have made an ingenious application of astringents in the treatment of reducible hernia. Mr. Lizars applied a very strong decoction of oak bark to the groin over a hernial tumor, the

hernia having been reduced, and by long-continued use the skin and subjacent parts were so constringed as to prevent the hernia from coming down.

INDIVIDUAL ASTRINGENTS.

Tannin, or Tannic Acid.—This is a peculiar substance existing in astringent vegetables generally, and is the chief cause of the astringency of vegetable matter. It is frequently associated with *gallic acid*, as in gallnuts, in most kinds of bark, and in tea; but in kino, catechu and cinchona little or no gallic acid is present.

It may be obtained in an *impure state*, by digesting bruised gallnuts, oak bark, etc., in a small quantity of cold water and evaporating the solution.

To obtain it pure, the plan is to act upon powdered nutgalls with sulphuric ether in a percolator.

Thus obtained it is in the form of powder; yellowish white; no smell; taste purely astringent without bitterness.

Effects.—Tannin is a pure and powerful astringent, and may be given in all the cases where such an agency is required. It has been used in diarrhœa, dysentery, fluor albus, in hæmorrhages, and in chronic catarrh. It has some reputation as a stomachic. A grain twice a day is said to increase the appetite.

Dose.—1 to 4 grs. every four hours, or oftener.

Gallæ.—Gallnuts.—These are excrescences produced on the branches of the *quercus infectoria*, a species of oak growing in Asia Minor, five or six feet high. The *cynips gallæ tinctoriæ* punctures the young branches of the tree and there deposits its egg. A morbid irritation ensues. In a few hours an excrescence is formed, and in a day or two attains its full size. This is the *gall.* Within this the insect undergoes its various changes; the egg is hatched; and the larvæ, feeding upon the interior of the gall, makes a hole in it. Finally, it changes into the state of fly and then eats its way out. Galls are found in the market in two different states, according as they are gathered before or after the insect escapes. The *black*, *blue*, or *green* galls, gathered before it escapes; the *white* galls after.

Gallnuts are nearly round; in size from a pea to a hazelnut, with small tuberosities on their surface. The best are the *black*, *blue*, and *green* galls. They have no external opening; heavy, compact, and brittle, and break with a resinous fracture. Internally of a whitish color, with a small hole in the centre. The *white* are inferior, have a loose texture, break with a powdery appearance, and have a large cavity in the centre communicating externally. These contain much less astringent matter—powder greyish.

Galls have no smell, but a bitter, astringent taste. Best galls are from

Aleppo.—*Composition. Tannic acid, gallic acid, a peculiar volatile oil,* and a peculiar acid discovered by Braconnet, and called by him *Ellagic acid.* The proportion of tannin in galls is greater than in any other known substance. As analysed by Sir Humphrey Davy, 100 parts contained 37 parts soluble in water and 63 parts insoluble (lignin). Of the soluble parts 26 were *tannic acid*; 6·2 *gallic acid*; with a little extractive; 2·4 *mucilage*, and 2·4 *saline* or earthy matters.

Galls give up their active principle to water, alcohol, and alkalies.

Incompatibles.—Metallic salts which throw down *tanno-gallates.* Isinglass throws down *tannate of gelatine.* Infusion of cinchona, *tannates of cinchonine and quinine.* Infusion of opium, *tannates of morphine and codeia.*

Effects.—One of the most powerful astringents we possess. From its bitterness not much used internally.

Forms. Powder—Dose—10 to 20 grs.

Infusion.—℥ ss to ℥ i.

Tincture.—ʒ ss to ʒ; used principally diluted with water as an astringent wash or gargle.

Ointment.—℥ i to ℥ vij of lard.

Ung. Gallæ Compositum.—Galls finely powdered, ʒ ij; opium powdered, ʒ ss; lard ℥ ij, M., an excellent application to piles when not very much inflamed.

Besides being used as a simple astringent, galls in the form of infusion are used as an antidote in cases of poisoning by the organic alkalies and those vegetables which contain them, such as nux vomica, hellebore, opium, &c. They form in these cases a *tannate* with the alkali, which has less activity than the alkali, because probably less soluble. Also in cases of poisoning by tartar emetic.—*Pereira.*

Catechu.—This substance is obtained from the *Acacia catechu*, a tree twelve or fourteen feet high, growing abundantly in the mountains of Hindostan. It is an *extract* obtained from the wood of the tree. The exterior white part of the wood is first cut off, and then the interior, which is reddish brown, cut into small chips, is boiled in water until all the soluble matter is dissolved. The decoction is then poured off and evaporated, until it becomes of a certain consistence, when it is spread upon cloth, cut into small pieces, and suffered to dry. This is the catechu of medicine. It comes in masses of different shapes and sizes, sometimes in square cakes, at others in roundish or irregular masses. The color varies from a reddish brown to a deep chocolate or liver color. Its texture is brittle; its fracture sometimes is rough, at others resinous; it has no smell; its taste bitter and astringent, leaving behind a sensation of sweetness.

There are a great many varieties of this article; they are all, however, the same substance, differing only in the mode of preparation.

Catechu is almost entirely dissolved by water and by alcohol.

Composition.—Tannic acid, a peculiar extractive, mucilage. In 1833 a peculiar substance was discovered in it, which was called *catechine* (catechinic acid).

According to the analysis of Sir H. Davy the proportions of ingredients were the following:

	Bombay Catechu.	Bengal Catechu.
Tannin,	54·5	48·5
Peculiar extract,	34·0	36·5
Mucilage,	6·5	8·0
Insoluble impurities (lime and sand),	5·0	7·0
	100·0	100·0

All the varieties of catechu are adulterated with sand, starch, and other impurities.

Effects.—One of the best and most powerful astringents, and slightly tonic.

Forms of Administration. 1. *Solid Lump.*—Dissolves in the mouth.

2. *Powder.*—Rubbed up with gum arabic and sugar, grs. x to ʒ i.

3. *Infusion.*—Dose ℥ i to ℥ i three or four times a day; used also in form of enema.

4 *Tincture.*—Dose ʒ i to ʒ iij mixed with sweetened water or port wine —very pleasant.

5. *Electuary.*—Dose ℈ i to ʒ ij.

6. *Lozenges.*—This is a good form when you wish to make an impression on the throat.

Kino.—This is a vegetable product obtained from different plants, and brought from different parts of the world. There are four different kinds of it described:

1. *African Kino.*—The product of the *Pterocarpus erinacea*, a tree growing on the western coast of Africa. The concrete juice obtained from incisions in the tree.

2. *East India or Amboyna Kino.*—Supposed to be the product of the Nauclea Gambia, a shrub growing in Malacca and Sumatra. This, however, is not ascertained.

3. *Botany Bay Kino.*—The product of the Eucalyptus resinifera, a lofty tree growing in New Holland. The concrete juice obtained from incisions into the tree.

4. *West India or Jamaica Kino.*—Supposed to be the product of *Cocoloba uvæfera*, but not certain—evidently an extract.

Of these varieties the *East India Kino* is the one said to be generally used and found in the shops. This comes in small, angular, shining frag-

ments of a deep brown or reddish color; opaque, hard, and brittle. In the mouth it softens, sticks to the teeth, and colors the saliva red; has no smell; an astringent, followed by a sweetish taste—easily pulverized.

Its best menstruum is diluted alcohol.

Composition.—*Tannic acid* and *peculiar extractive* 75, *red gum* 24, *insoluble matter* 1. Recently *catechine* has been discovered in it.

Incompatibles.—The same as galls.

Effects.—Astringent, without any tonic power—inferior to catechu.

Forms.—*Powder*, x to xxx grs. *Infusion*, ʒi to ℥ij. *Tincture*, ʒi to ʒij. Locally, in powder, to flabby ulcers, and as a gargle, injection, and wash.

Oak Bark.—The species of oak from which this is obtained in Europe is the *Quercus pedunculata*, or the *quercus robur* growing in England and all over the continent. In this country it is obtained from the *quercus alba*, a species of oak very analogous to the English oak. It grows in every part of the Union, but abounds most in the middle states —so called from the white color of the bark.

Oak bark, deprived of its epidermis, is of a light brown color; coarse, fibrous texture, and not readily pulverized; has a feeble odor and a rough, astringent, bitterish taste. Water and alcohol both extract its virtues.

Composition.—*Tannic acid*, *gallic acid*, *tannates of lime*, *magnesia*, and *potash*, *uncrystallizable sugar*, *pectin*, and *tannin.*—Pereira.

The proportion of tannic acid in the bark varies with the size and age of the tree, and the season of the year when gathered. The *young* bark contains the most; and according to Sir H. Davy, the bark collected in the *spring* contains four times the quantity that it does gathered in the *winter*.

The inner part of the bark contains the greatest proportion of tannin, the cellular or middle portion less, while the epidermis contains none at all.

Effects.—Astringent and somewhat tonic.

Administration.—*Powder*, ʒss to ʒi.

Decoction, ℥i to ℥ij. Principally used as a local application—gargle—injection.

Statice Caroliniana (*Marsh Rosemary*).—A small maritime plant indigenous in this country, from six to twelve or more inches in height; grows in the salt marshes along the sea coast from Maine to Florida. The part used is the *root:* this is large, spindle-shaped, fleshy, rough, and of a purplish brown color. No smell; taste bitter and astringent. Water extracts its virtues.

Composition.—Tannic acid, gallic acid, extractive matter, and some common salt.

Effects.—Powerfully astringent.

Forms. *Decoction.*—Boiling ʒij in ℥xii water—used internally and externally.

The decoction of marsh rosemary is much used as a gargle in the different varieties of sore mouths, venereal sore throat, cynanche maligna, &c. In the second stage of diarrhœa it has great reputation in some parts of the country.

GERANIUM MACULATUM (*Spotted geranium*, *Crow's foot*, *Crane's bill*).—A plant from one to two or three feet high, growing in every part of the United States in low grounds and damp woods. The part used is the *root*, which is taken up in the autumn and dried; comes in pieces two or three inches long, and one third to half an inch thick; externally rough and dark brown; internally pale flesh color; has no smell; taste astringent, but not bitter or unpleasant; if properly dried brittle and easily reduced to powder. Its virtues extracted both by water and alcohol.

Composition.—*Gallic acid* in large quantity, *tannic acid*, small quantity of *mucilage*, *starch*, *red coloring matter*, *resina* small quantity, and a *crystallizable vegetable substance.*

Effects.—An excellent astringent of considerable power; has the advantage over many other articles in its pleasant taste. Hence a good article for children and delicate stomachs.

Administration. *Powder.*—Dose twenty to thirty grains.

Decoction.—℥i of bruised root boiled a few minutes in a pint of water or milk. Dose ℥i to ℥ij.

Tincture.—Dose ʒi to ʒij.

ACETAS PLUMBI.—This salt is known by the common name of the *Sugar of Lead*, and is generally prepared by the manufacturer on a large scale.

Physical Properties.—Sugar of lead is a white crystalline salt without smell—its taste is sweetish and astringent. When exposed to the atmosphere it slightly effloresces; soluble both in water and alcohol; water at 60° dissolving four times its weight.

Chemical Composition.—One eq. of acetic acid 51, one of prot. of lead 112, and 3 of water, 27=190.

Test of its Purity.—Dissolved in distilled water free from carbonic acid, if pure, it makes a perfect solution. To ascertain this sulphuric acid or sulphuretted hydrogen in excess being added to the solution to throw down the lead, the supernatant liquid should be completely volatilized by heat; any fixed residue is impurity.—(Pereira, vol. i. p. 516.)

Incompatibles.—"All those acids and their compounds which form with oxide of lead salts nearly insoluble in water, as the sulphuric, muriatic, carbonic, citric and tartaric. It is decomposed by lime water, by the alkalies,

ammonia, potash, and soda; the two latter, if added in excess, redissolve the precipitate at first formed. Hard water usually contains three ingredients which decompose it, viz.—carbonate of lime, sulphate of lime, and muriate of soda; and hence, when dissolved in such water, the solution is always turbid. It is decomposed by solution of sulphuretted hydrogen, which gives a black sulphuret; liquor ammonia acetatis also decomposes it, on account of the carbonic acid diffused through it."—(Phillips, p. 127).

Effects.—Sugar of lead acts as an astringent to the part with which it comes in contact, whether taken internally or applied externally. Taken internally in moderate doses, its immediate effect is to constringe the vessels of the mucous membrane of the alimentary canal, and so lessen secretion from them. Hence costiveness is one of its immediate effects. If its use be continued, the same astringent effect is extended to other parts of the system. This is especially manifested in the mucous membranes, the skin, and the urinary organs, in all of which the secretions are lessened. In addition to this the temperature of the body is diminished, and the pulse is lessened in force and frequency. In its general operation, therefore, it acts as an astringent and a sedative.

If the use of it be persisted in too long, it produces in common with the other preparations of lead, certain striking effects on the nervous and muscular systems—one of these is a form of colic, called the *painter's colic*—the other is a peculiar kind of *paralysis*.

If a large dose of the sugar of lead be taken at once, it acts as an irritant poison.

Mode of Administration.—The ordinary mode of giving sugar of lead is in pill, in doses of one or two grains, repeated every two, three, or four hours, according to circumstances. Most generally it is given in combination with opium.

Solution.—℥ ij to a pint of water.

Diseases in which used.—Hæmorrhages, excessive secretion from the mucous membranes, cholera, diarrhœa, chronic dysentery, night sweats.

Goulard's Extract.—This is the *liquor plumbi subacetatis*, or the solution of the subacetate of lead. It is called Goulard's Extract from M. Goulard, a surgeon of Montpelier, by whom it was more especially introduced into notice.—(Pereira, p. 518.)

According to the United States Pharmacopœia, this is prepared by taking of the acetate of lead and of the semi-vitrified oxide of lead (litharge) each eight ounces, mixed in a glass vessel, and boiling for twenty minutes in two pints of distilled water, then filtering through paper. During this process the protoxide is dissolved and a subacetate is formed, which is held in solution.

Properties.—Goulard's Extract is either transparent or colorless, or it has a slight greenish yellow tint, arising from impurities in the distilled vinegar;

(U. S. Disp., p. 956); its taste is sweetish and astringent. It is readily decomposed. Common spring water throws down the oxide of lead in large quantities. Carbonic acid throws down the carbonate of lead. This happens from mere exposure to the atmosphere. Even distilled water, if exposed to the atmosphere, produces the same effect, by the carbonic acid which it contains.

From the effect of carbonic acid on it, it should always be kept in tight bottles.

Effects and Uses.—This is only used externally as a local application, and its effect is analogous to that of the solution of sugar of lead. It acts as a local astringent and sedative in cases of local inflammation.—(See Pereira.)

When used it requires to be diluted; about four drachms require a pint of water to be added. It is an excellent application to piles where there is little inflammation.

GOULARD'S WATER.—This is the *liquor plumbi subacetatis dilutus*, an officinal preparation made by adding a drachm of Goulard's extract to a pint of distilled water, with the addition of a drachm of proof spirit. The objection to this is, that it is too weak.—(See Pereira.)

ALUM.—This is a triple salt consisting of alumina, potash, and sulphuric acid. In some places it is found native, effloresced on the soil in volcanic regions. This is the case near Naples. The alum "is collected and lixiviated, and the solution made to crystallize by slow evaporation in leaden vessels sunk in the ground."—U. S. Disp.

Most commonly, however, it is obtained from the alum ores. It is also manufactured by a direct combination of its constituents. This is the mode in this country, where all the alum for domestic purposes is now prepared.

Properties.—Alum is a white crystalline salt, with a sweetish, acidulous, astringent taste, without smell. On exposure to the atmosphere it slightly effloresces, its solution reddens litmus paper, "but changes the blue tinctures from the petals of plants green. It cannot, therefore, be properly said to contain an excess of acid."—(U.S. Disp.,) Alum is soluble in five times (Phillips) (W. & B. say 15 times) its weight of cold water, and three-fourths of its weight of boiling water. Alum contains a large proportion of water of crystallization, amounting to nearly 50 parts in 100. By exposure to heat it undergoes watery fusion. By increasing the heat the alum swells, the water is driven off, and it becomes a white, friable, spongy mass. This is called *Alumen exsiccatum*, dried alum, or *Alumen ustum*, burnt alum.

Effects.—Alum is one of the most powerful astringents that we possess. When first taken internally, if the stomach be at all delicate or irritable, it is apt to cause gastric uneasiness, nausea, and sometimes vomiting. To a certain extent this may be obviated by combining it with some aromatic.

Besides this, the best plan is to begin with small doses, and to increase gradually as the stomach is found to bear it. On the bowels the general effect is to produce constipation. In large doses, however, it, on the contrary, causes irritation, griping, and purging.

In its general operation on the system alum proves stimulant. Its use, therefore, should be limited to those cases in which a stimulant astringent is required.

Burnt alum differs from common alum only in not having any water of crystallization. It is more astringent.

Forms of Administration. Substance.—It may be taken in powder or pills made up with some tonic or aromatic, in doses of from five to ten grains.

Alum Whey.—This is made by boiling ʒ ij of alum with a pint of milk, and then straining. Of this a wineglassful at a time may be taken. This is a very pleasant and good way of administering alum.

As a Local Application. Powder.—The burnt alum is applied to indolent ulcers to destroy spongy granulations.

Solution.—As a gargle, collyrium, and injection.

Plug.—A solid stick of alum cut round, introduced into the vagina in cases of hæmorrhage from uterus.

[*Vaginal Injection.*—A very weak solution of alum will suit a larger number of cases of vaginal relaxation and free secretion than any other astringent I know of. It should be very weak—my rule is to make it just strong enough to taste of alum.—Ed.]

Sulphuric Acid.—In its pure state, sulphuric acid is not used in medicine. In a state of dilution there are two preparations which are officinal:

1. The *Acidum Sulphuricum Dilutum.*—This is prepared by adding gradually, and then mixing, one fluid ounce of sulphuric acid with thirteen fluid ounces of water.

2. *Acidum Sulphuricum Aromaticum.*—This is known by the common name of the *Elixir of Vitriol.* It is prepared by digesting for three days in a close vessel three ounces and a half of sulphuric acid with two pints of alcohol, then adding bruised ginger one ounce, and cinnamon bruised one ounce and a half, and letting the whole macerate for a week, and then filtering. This forms a dark brown liquid, having an acid taste and peculiar aromatic odor. Both these preparations of sulphuric acid are taken in the same doses and in the same way. From ten to thirty drops, in a cup of cold water, may be repeated three or four times a day.

Effects.—In the two preceding forms sulphuric acid is astringent, refrigerant, and tonic. It gives tone to the digestive organs, improves the appetite, and checks excessive secretion. Over the skin it exerts a peculiar agency, checking profuse sweating more effectually, perhaps, than any other astrin-

gent. On the urinary organs its effect is to increase the secretion of urine, and to render it acid. "Under its use the milk frequently acquires a griping quality."—(Pereira, vol. i. p. 265.)

If the use of this acid be continued too long, it produces a slow irritation of all the digestive organs, heat and pain in the stomach, griping, purging, and general constitutional irritation.

In its pure state it acts as an irritant poison.

Acetic Acid.—It is only in its impure state, or that of vinegar, that this acid is used internally.

Effects.—Vinegar is astringent, refrigerant, and tonic. Taken in moderate quantities it gives tone to the digestive organs and increases the appetite. In its general action, it lessens the heat of the system, checks secretion, and gives tone. If taken in too large quantities it irritates the digestive organs, causing pain and griping, and if persisted in produces general emaciation. On this account it is frequently given to correct too great obesity.

Mode of Administration.—One or two ounces may be added to a quart of water and drunk freely.

Matico.—This very popular astringent was brought to the notice of the profession in the United States by Dr. Rushenberger, U. S. N., who obtained a knowledge of it in South America. It consists of the leaves and unripe fruit of a species of pepper, probably the piper angustifolium. R. and P. It has a pleasant aromatic odor and a feeble astringent taste. It contains volatile oil, resin, and tannic acid; the latter in small quantity. It is very strongly recommended as an astringent to check hæmorrhages from leech bites, etc., where it can be directly applied. It is also used internally in epistaxis, hæmorrhage from the bowels, uterus, etc., and cases have multiplied in which most wonderful effects are said to have been realized from it. Whether subsequent experience will confirm the hopes excited by these reports is of course uncertain.

Mode of Administration.—Infusion.—(℥ i to o j water). Dose ℥ j.

REVULSIVES.

By Revulsives are meant those agents which excite an action in one part of the system, and in consequence overcome a morbid action existing in some other part. They are also called *Derivatives* and *Counter-Irritants.* Usually these terms are limited to those agents which are applied to the external surface of the body. They may, however, be applied with equal propriety to agents taken internally. Revulsives may, therefore, be divided into two classes :—

1. Those which exert their action on the skin.
2. Those which act on some portion of the mucous tissue.

Under this latter class are embraced emetics, cathartics, etc. It is of course only with the former class that we have now to do.

Before giving an account of individual revulsives, I will make a remark or two upon the principle upon which they are supposed to act. In observing the operations of the animal economy, in various states of derangement from perfect health, it is remarked that morbid actions or irritations are frequently transferred from one part to another, and that in this case the primary one not uncommonly yields altogether to the secondary. This has been observed so repeatedly as to justify us in considering it as a kind of general law. It was in accordance with this that John Hunter laid down the too sweeping generalization that two diseases could not exist at the same time. *Why* it is, or *how* it is, that one irritation thus yields to another, it is impossible to say, and I shall therefore not spend any time in useless speculation in relation to it.

Now it is upon this simple law or fact that the use of all external revulsive agents is founded, experience having shown that actions or irritations excited by artificial means are capable of producing effects precisely analogous to the spontaneous irritations set up by nature. Revulsive medication then is nothing more than an imitation of the method of cure frequently instituted by nature herself. This is the principle upon which the use of revulsive agents is founded.

REVULSIVES ACTING ON THE SKIN.

They may be divided into several classes according to the degree of effect which they produce.

1. Those which simply promote the flow of blood to the part.
2. Those which produce moderate irritation.
3. Those which blister.
4. Those which produce eruptions of various kinds.
5. Those which destroy the texture of the part—caustics, issues.

1. Those which Promote the Flow of Blood to the Part.—To this class belong *friction*, *warmth* applied in various ways, such as bottles of hot water, bags of hot salt, etc., *warm bathing*, local and general. These, though simple, are important and valuable revulsive agents. Under continued friction the sensibility and heat of the part are augmented, while at the same time an increased flow of blood takes place. The warm bath is still more effective, especially if impregnated with salt. By these agents the most striking and beneficial results are frequently produced in the way of revulsion.

2. Those which produce Moderate Local Irritation.—They are commonly called *rubefacients*. By this is meant those substances that simply produce redness, and a certain degree of irritation of the part to which they are applied, without causing any discharge. They are used with great advantage in many cases where the operation of blisters would be unnecessarily severe. Among the best of this class are the following:

(*a.*) *Aqua Ammoniæ.*—This may be used either pure or in combination with sweet oil, and in either way makes an excellent rubefacient application. A piece of flannel soaked in aqua ammoniæ and laid on the skin will, in a very short time, excite considerable pain, redness, and inflammation. If the strong aqua ammoniæ is used, it will blister very speedily. The more common form of using it is in combination with sweet oil, and then it forms what is known as the *volatile liniment*. In this preparation a chemical union takes place between the oil and the ammonia, and a white soap is formed, which is kept fluid by the water of the ammonia. The proportion of oil and ammonia must vary with the strength required. In some cases equal parts are necessary, while in others a third or a fourth of ammonia will answer. For children the proportion of ammonia, of course, must be less than for adults.

(*b.*) *Sinapis.*—This is perhaps the best of all the rubefacient articles, and from it is derived the term *sinapism*. If it be desired to have its full strength, it is prepared by mixing the pounded mustard with water into a thick paste or poultice. The common practice is to mix it with vinegar; this, however, rather impairs the strength of the mustard. Applied to the skin in this state in a very few minutes it causes a sense of warmth in the part, and in the course of half an hour severe pain. When taken off the skin is red and burning. If it be left on too long actual vesication takes

place, and in some cases troublesome ulceration follows. This, therefore, should be avoided. The best plan is to remove it as soon as severe pain is felt, and be careful in leaving it too long on parts possessed of little vitality. By adding flour, its strength may be regulated. In applying it to children, this should be specially attended to. Although an exceedingly efficient and useful rubefacient, this article, therefore, requires to be managed with caution.

(*c.*) *Capsicum.*—This is an excellent rubefacient, and used in various forms. It may be made into cataplasm, or the saturated tincture may be rubbed on the surface. As a liniment it may be prepared by mixing it with hog's lard. Another simple and good form of using it, where counter-irritation is to be made to the feet, is to dust the insides of the stockings with the dry powder. This keeps up a moderate degree of heat and irritation in the feet, and is exceedingly useful where there is a tendency to coldness of the extremities, accompanied with headache.

(*d.*) *Oil of Turpentine.*—This is also a good rubefacient. If applied undiluted it causes considerable smarting and irritation, and is sometimes followed by a vesicular eruption. In this state it may be used in the way of friction, by means of a piece of flannel soaked in the turpentine. The more common way in which it is used is that of a liniment, in combination with other rubefacient articles.

(*e.*) *Tincture of Cantharides.*—This is sometimes used as a rubefacient; and the experiments of Dr. Alexander prove, that when made by putting ʒi of cantharides into ℥iv. alcohol, it is just strong enough to cause irritation of the skin, and not vesicate. This is exactly the strength ordered in the U. S. Pharmacopœia. An ordinary blister, if taken off early enough, may be made to produce a rubefacient effect only.

(*f.*) *Camphor* dissolved in alcohol is a common and useful rubefacient. It is one of the ingredients in the common opodeldoc, which consists of soap ℥vii, alcohol ℥ij, camphor ℥ij, liquor ammoniæ ʒiv, oil of rosemary ʒss.

(*g.*) *Pix Burgundica.*—This is the resin obtained from the *Pinus abies*, or fir tree. The ordinary mode of using it is in the form of plaster. Applied in this way it excites in the course of a day or two considerable irritation of the part, which is followed by a slight effusion of serous fluid. From the mildness and slowness of its action, it is not adapted to cases where a prompt revulsion is called for. For the purpose of rendering it more active and irritating, a small portion of blistering ointment may be added to the pitch, while cooling, just before the plaster is spread.

(*h.*) *Alium Sativum.*—Garlic has long been known and used as a local irritant. It sometimes, though not often, causes vesication. It is used very much in the same way and in the same cases as mustard. As an application to the feet of children after soaking them it is excellent.

(*i.*) *Oleum Monardæ Punctatæ.*—The *Monarda punctata*, or horse mint,

is a native plant of this country, and yields an oil which possesses admirable rubefacient properties. If rubbed on the skin it speedily causes redness and irritation, and sometimes vesication if its application be too long continued. It was first noticed by Dr. Atlee, of Philadelphia, who recommends it in the form of a liniment with camphor and opium. Properly diluted it may be used in all cases where an ordinary rubefacient is required.

3. Those which blister.—These are called *epispastics* or *vesicants.* The term epispastic is applied to those agents which possess the power of irritating and inflaming the skin in such a way as to be followed by the formation of vesicles.

The effects of these agents are obvious. The part to which they are applied undergoes all the changes of ordinary inflammation. Increased sensation is first experienced, then comes on heat, redness, swelling, and pain. To these succeeds an effusion of serous fluid from the excited exhalants, and a consequent separation of the cuticle, forming a vesicle or blister. On removing the epispastic and discharging the serum, the part, unless again irritated, gradually heals, new cuticle forms, and in a few days the whole is restored to its natural state.

With these local effects the constitution is more or less sympathetically affected. Like all local inflammations, the effect of blisters is to increase the action of the heart and arteries. The vascular excitement thus produced, however, is rarely excessive, and speedily subsides with the removal of the cause producing it. The nervous system, too, is excited by the action of blisters. In certain conditions of that system, the stimulus of these agents increases the tone and energy of the brain. This is so marked that some persons have resorted to the application of them to excite them previously to great mental efforts. The celebrated English barrister, Dunning, is reported to have been in this habit. Dr. Thompson states, that the late Sir James Mackintosh tried the effect of it in one of his efforts before the House of Commons, and with great success.—Vol. ii. p. 535.

Blisters, then, act both as local and general stimulants. This double operation it is important to bear in mind in the application of these agents in different stages of disease.

CIRCUMSTANCES MODIFYING THESE EFFECTS.

(*a.*) *Age.*—From the peculiar delicacy of the skin in young subjects, blisters produce their effects much more speedily than in adults, at the same time that the constitutional irritation which they occasion is much greater. In some cases, especially if left on too long, the inflammation runs rapidly into gangrene, and proves fatal. In young subjects, therefore,

the greatest caution should be exercised in watching the effects of blisters. In old persons, too, from the torpid condition of the capillaries, the inflammation of a blister may readily assume an unhealthy character.

(*b.*) *Sex.*—From the greater delicacy of the female system, blisters as a general rule are apt to produce more irritation than in males. In the use of them this fact ought always to be borne in mind. During the state of pregnancy their effect is modified. The system then is in a state of increased excitability, and in consequence of this the local as well as general irritation which they produce is apt to be much greater. According to Dr. Dewees they are more apt during pregnancy to produce strangury. In some cases too, premature labor has been produced by them. Dewees records two instances of this sort.*

(*c.*) *The peculiar character of the Skin.*—It is well known that in this respect there is every variety. In some persons the skin is naturally thin, delicate, and irritable. In these the slightest causes frequently excite an unnatural degree of inflammation, followed by proportional constitutional disturbance. In others, again, the skin is thick, tough, and torpid; in these, of course, local irritations are more tardily produced, and affect the system less. Now in these different states of the skin it is evident that the effects of blisters must differ considerably, and this you will find to be the case.

(*d.*) *Temperament or general habit of Body.*—This also greatly modifies the effects of blisters. In irritable habits they frequently cause a great degree of nervous and vascular excitement. I have met with cases of this kind in which a state little short of phrensy has been induced. In habits of an opposite character they produce little or no constitutional irritation. In persons much reduced and broken down by debilitating causes, troublesome ulceration and gangrene not unfrequently follow their application.

(*e.*) *The part to which the Blister is applied* modifies its effect. A blister applied to the scalp takes twice the time to produce its effect that it does on other parts. (Chapman, p. 228.) If a blister be applied to the scalp immediately after the hair is shaved off, strangury is almost always produced, an effect which does not follow if the application be delayed for twenty-four hours.*

(*f.*) *The length of time the Blister is kept applied* modifies greatly its effects. In the case of the ordinary blister, if the application be continued beyond a certain time, strangury is apt to be induced.

(*g.*) *The actual condition of the patient as to disease.*—No circumstance modifies in so important a manner the effects of blisters as this. If applied in the early stages of high inflammatory or febrile excitement, they act as general irritants, increasing heat and quickening the pulse; while in the more advanced periods they produce a salutary revulsion without any

* Treatise on Females, p. 128-9.

* Percival's works, v. i, p. 129.

of these effects. In certain conditions of the brain and nervous system, the skin loses its sensibility, and blisters do not produce any effect.

From what has already been advanced it must be evident that there are certain conditions of the system in which blisters are *contra-indicated.* As a general rule they ought never to be used where there is present a high degree of general febrile or inflammatory excitement. The reason of this must be obvious, if we reflect for a moment upon the effects of a blister. These are local irritation and general excitement. Now in all cases where a local inflammation exists, the difficulty of resolving it by any means will always be proportioned to the degree of general excitement accompanying it. If a blister be applied when the general excitement is already very great, one of the effects will be to aggravate this, and thus to counteract the beneficial agency of the blister as a revulsive. Under these circumstances the primary inflammation, instead of being relieved, must be aggravated by the increase of the general excitement. Hence it has been generally observed that if blisters be applied in cases where great general excitement is present, antecedently to suitable evacuations, they do more harm than good. They merely add fuel to the fire.

Another condition of the system in which they are contra-indicated is that in which great constitutional exhaustion or emaciation is present. From the impaired state of the vital powers, gangrene and death may ensue.

The condition of the system most favorable to their use is that in which the general excitement is rather below than above the natural standard. In this state of things irritations are most readily transferred from one part to another.

Modes in which Blisters prove Curative.—There are three.

1. By exciting a new action in the part to which they are directly applied. In this way they sometimes arrest the progress of erysipelas.

2. By their stimulating effect on the general system. In this way they sometimes prove beneficial in low fevers, in paralysis, &c.

3. As derivatives they relieve inflamed and congested parts by directing the flux of blood to the surface and from the diseased part or organ.

INDIVIDUAL EPISPASTICS.

Cantharides.—The insect used for ordinary blistering is the *Meloe vesicatorius,* or more properly the *Cantharis Vesicatorius.* It is found adhering to the leaves of a number of plants, such as the ash, elder, lilac, white poplar, &c., in Spain, France, and Italy. From its having been made an article of commerce more particularly in Spain, it has received the name of the *Spanish fly.* The mode of collecting them is by simply shaking

them from the branches of the trees early in the morning, while they are yet in a torpid state from the cold of the previous night. This is done by persons covered with masks and gloves, who receive them on cloths spread under the tree. After this they are instantly put into a sieve and exposed to the fumes of boiling vinegar. This kills them, and after this they are dried either by the sun or in a stove.

The cantharides belong to the beetle tribe of insects. They are from six to ten lines in length, and two or three in breadth, of a golden greenish color, and when alive have a fœtid, penetrating odor, by which swarms of them may be detected at a distance. At Dijon, in France, it is stated that the public walks were at one time deserted in consequence of the disagreeable odor occasioned by these animals.—*Dict. Mat. Med.* vol. iv. p. 300.

When dried they retain a good deal of this offensive odor—their taste is acrid. The powder which they yield is of a greyish brown, mixed with shining particles.

To have them good they should be kept perfectly dry; when suffered to become moist they lose their vesicating property. They should, therefore, be occasionally spread out and exposed to the air. If kept in bottles tightly closed, they retain their virtues for a great length of time.

Adulterations.—In the state of powder cantharides may very easily be adulterated by the admixture of various articles. The only way to obviate this is to buy in the insect state.

In this state, however, they are frequently mixed with another insect, the *Melolontha vitis.* This is distinguished by its square form and black feet; as this insect does not possess any vesicating power, it should be carefully separated.

Chemical Composition, &c.—By the researches of modern chemistry the vesicating property of the cantharides has been found to reside in a peculiar principle which is called *Cantharidin.* This was discovered by Robiquet in 1810. It is obtained in small crystalline micaceous plates, insoluble in water and cold alcohol, but soluble in boiling alcohol, ether, and oil.

Effects.—The effects of cantharides applied as a blister are those already described under the head of epispastics generally. In addition to these, however, they produce under certain circumstances another effect, caused by no other agent belonging to this class, and this is strangury, a peculiar irritation of the urinary organs, accompanied by a spasmodic constriction of the sphincter of the bladder. There are great pain and difficulty in voiding urine, and the quantity which is discharged is exceedingly small. The circumstances under which this effect is most likely to occur, are those in which the protecting power of the cuticle is either impaired, or entirely destroyed. Thus:

1. When the blister is kept on so long that the cuticle is entirely removed, and the blister then comes in actual contact with the subjacent parts.

2. When the blister is applied to a part recently shaved, as the scalp.

3. When the blister is applied to parts where the cuticle is already destroyed, either by previous blistering, wounds, ulcerated surface, and the like. Under all these circumstances may this effect be produced.

Modes of Application. The Ointment.—This is the ordinary and best mode of applying cantharides for the purpose of vesication. This ointment is made of resin, wax, and oil, or lard. In preparing it, great care should be taken not to add the flies to the other ingredients while they are hot, as heat impairs the vesicating power. This is the reason why in the Pharmacopœia it is directed that the flies are to be added just as the other ingredients are cooling and becoming solid. For the same reason in spreading a blister, care should be taken not to soften the ointment by means of heat.

In preparing and applying a blistering plaster there are several things important to be observed:

1. The plaster should be spread thick. If this is properly done the vesication is not only more certain, but is produced in a shorter time. On the other hand, if the plaster be spread thin the vesication is apt to be imperfect and in patches, and requires a longer time. Linen is better than leather.

2. The practice so very common of sprinkling the plaster over with dry fly powder cannot be too severely reprobated. Although intended to make the blister more potent, it always has a contrary effect. The blister never draws so well, probably in consequence of its not adhering so closely to the skin. Besides strangury is much more apt to follow from the particles of the powder adhering after the blister has been removed.

3. Let the surface to which the blister is applied be properly cleansed, and if it be cold and torpid, or if you wish the blister to act very promptly, stimulate the skin by some rubefacient, as turpentine, mustard, or the like.

4. It is important that every portion of the blister plaster should be kept in actual contact with the skin, otherwise the vesication will be in patches. To prevent this put a bandage over the blister, or fasten its edges down with adhesive straps.

5. The usual period for leaving on a blister in an adult is twelve hours, but there is every variety, as before noted, in the sensibility of the skin; the best plan is to raise a corner of the plaster after eight hours, and if small vesicles are formed, the work is done, the plaster may be removed, and simple cerate substituted.

6. Where blisters are used to subdue internal inflammation they should be large; the same amount of irritation follows a small as a large blister, and the amount of proper and useful counter-irritation is null.

7. Remember that in internal inflammations the great principle on which blisters prove curative is, that they excite an irritation more powerful than the inflammations are. Of course, when the inflammation runs high, this

is impossible; always under such circumstances reduce the inflammation *to the blistering point* by venesection, evacuants, &c.

4. Agents which produce Eruptions and Pustules.—These differ very materially in their effects from blisters. They are more permanent in their operation. The inflammation which they produce is of the phlegmonous character, while that excited by blisters is erythematic.—(Thompson, vol. ii. p. 536.)

(*a.*) Tartar Emetic.—Although the peculiar effects of this substance on the skin had been previously noticed, and some practical applications, indeed, had been made of it, yet it was not until the year 1821 that it was fully brought before the public as a revulsive agent. In an essay written expressly on this subject, Dr. Jenner gave, at that time, a full account of its successful application in a number of cases, and since then it has been in extensive use. There are two modes in which it may be applied—in the form of strong solution or of an ointment. Rubbed on the skin in either way, local irritation is first produced, which is succeeded by a crop of pustules, resembling in their appearance and progress those of small-pox. The first of these modes was originally suggested in 1773, by Dr. Bradley, of London. The second is that recommended by Dr. Jenner, and is the one commonly used at present. The formula for the ointment, as proposed by Dr. Jenner, is the following:

℞	Antimon. Tart. (subtil. pulv.)	ʒij.	
	Ung. Cetacei . .	ʒix.	
	Sacch. alb. . . .	ʒi.	
	Hyd. sulph. rub. . .	gr. v.	M.

The sugar is added merely to prevent the ointment from becoming rancid. Every purpose, however, may be answered by simply rubbing up a suitable proportion of tartar emetic with lard. The length of time which it takes to produce its effects varies with the strength of the application and the susceptibility of the skin. When it is desirable to bring out the pustules as speedily as possible, the skin should be previously prepared by friction, either dry or with strong vinegar. The ointment should then be rubbed on the part briskly for ten or fifteen minutes. In this way a crop of pustules will be brought out in a few hours. Where it is not required to produce the effect so rapidly, a portion of the ointment may be rubbed on the part for a few minutes twice a day; and, generally, in the course of one, two, or three days, the effect will begin to show itself.

When the solution is used, after preparing the skin by friction, it should be applied as hot as it can be borne. Pustules are thus rapidly produced. "They are small and numerous, and speedily heal, leaving no traces

behind them."—Thompson, vol. ii. p. 555. This is a mode well suited to females.

When the eruptions come out large and full, they are sometimes exceedingly painful, and cause a great deal of irritation. The best dressing in this case is a bread and milk poultice or simple cerate.

If it be desirable to keep out the eruption for some time, fresh applications of the ointment may be made.

From the effects of tartar emetic thus applied, it is evident that its action is entirely different from that of an ordinary blister. It not merely irritates the skin, but produces actual disease of that structure, and to this circumstance, no doubt, may its efficacy in many cases, as a revulsive, be attributed.

(*b.*) Croton Oil.—Rubbed on the skin croton oil produces, after two or three days, a fine pustular eruption. It is usually combined with two or three parts of olive oil. As a revulsive it is less severe than tartar emetic, and more permanent in its operation than a blister. It sometimes but rarely purges, which is an objection to its use.

(*c.*) Nitro-Muriatic Liniment.—A liniment composed of nitro-muriatic acid and spirits of turpentine; produces effects somewhat similar to those of croton oil. It is made by mixing two parts of acid with one of turpentine, and five of camphorated oil or simple lard. Rubbed with a sponge on the skin it will cause redness and heat in four or five minutes. If continued, small vesicles make their appearance, and a further rubbing causes excoriation and a free exudation of serum. As a local irritant this has the advantage of producing immediate effect. The pain is said not to be very severe.

This is said to be the liniment of the notorious London Quack, St. John Long.

There remain only to be considered those revulsives which destroy the texture of the parts to which they are applied, or so affect it as to cause a permanent suppuration, or as the phrase goes, keep up a discharge from the part. These are *issues*, *setons*, and *moxas*.

Issues.—These are artificial ulcers created in different parts, to produce local irritation and a purulent discharge.

They are made in different ways:

1. By making permanent blisters. This is done by dressing the blistered surface with some irritating salve, as savin or the like, so as to keep it open and promote suppuration.

The best salve for this purpose is Ung. cantharides one part, Ung. Sabinæ seven parts.

2. By making an incision of suitable size, and putting one or more peas in it, securing them by a bandage or an adhesive strap.

3. By applying pure nitric acid to the part, and thus destroying the vitality of the skin. When this sloughs out the sore may be kept open either by peas or by the occasional use of an irritating salve.

4. Issues may be made by the actual cautery. In using this, great care is required to have the iron at a white heat, and to apply it rapidly. This is much used in France, especially to the os uteri.

Seton.—This is a cord of silk or thread inserted by means of a flat seton needle under a small portion of the skin and cellular tissue; it soon excites a suppuration, which may be increased by drawing the thread backwards and forwards, and also by putting an irritating ointment on the thread and drawing it into the wound. Of these modes of getting a discharge from the skin the blister issue is the least severe, the seton the most so, and probably the most effectual. The nitric acid issue is preferred by most surgeons, I believe.

Situations in which Issues or Setons may be made.—They should not be put over a bone or tendon when covered only by skin, nor in immediate proximity to a large nerve or blood-vessel, nor on the belly of a muscle. The best situations are:—1st. The back of the neck. 2d. The middle of the humerus, near the insection of the deltoid. 3d. In the hollow on the inside of each knee, above the flexor tendons. 4th. On each side of the spinous processes of the vertebræ. These are the best places, but issues may be put wherever there is beneath the skin enough cellular substance to protect the parts below.

Effects as compared with Blisters.—Issues produce less local irritation and more discharge, and their operation is much slower.

Moxa.—This remedy was introduced by Baron Larrey, who became acquainted with it during Napoleon's campaigns in Egypt. It is made by rolling carded cotton or some similar combustible into a cylinder about an inch long and half as thick. This is applied to the skin and kept in contact with it by means of a metallic ring and handle. The moxa is then set on fire, and the combustion hastened, if necessary, by a blowpipe. The influence of the fire should be limited by covering the part with a bit of wet cloth, having a hole in its centre the size of the moxa; when the combustion is completed the parts should be washed with strong aqua ammoniæ, which greatly relieves the pain. An eschar is thus formed, and when the slough separates it may be dressed with ointment, stimulating or not, as it is desired to heal or keep open the sore. The effect of the moxa differs from the actual cautery with the iron, in that the heat being more gradually applied penetrates deeper. The same rules and restrictions as to the parts on which they may or may not be placed, apply to moxas as to issues. Moxas are made of cotton, recommended by Larrey; this may be previously soaked in a solution of nitre or chlorate of potash,

or of a coil of paper similarly soaked and dried, or the bulb of the sunflower. Their effects do not vary, the degree of inflammation depending on the closeness with which the moxa is applied to the skin, its size, and the intensity of the combustion.

PRACTICAL APPLICATION OF REVULSIVES.

1. Of those which simply promote the flow of blood to the surface. Wherever internal congestions exist, and the surface is consequently cold, torpid, and comparatively bloodless, revulsives of the first class are proper. Hence their use in the early stages of fevers, inflammations, and congestive diseases. Their range is from the slight chillness produced by transient exposure to cold, and cured by soaking the feet at bed-time, to the intense congestion of typhus, when the whole body may be enveloped in hot blankets, or the hot bath used.

2. The rubefacients act in the same way, and are appropriate in the same wide range of cases.

3. *Of Blisters.*—These, though acting on the same principle, are used in cases where the difficulty to be overcome is of a more serious and more permanent character. As blisters are extensively used, and as their use, unlike that of the two previous classes, is pretty sure to do harm when it does no good, let us refer in detail to some of the diseases in which they are used.

1. *Fevers.*—Here everything will depend on the stage of the disease, and the state of the system. Blisters should never be used till the general excitement has given way to the use of evacuants; then they aid in breaking up the remains of the disease and preventing or removing local determinations.

2. *Inflammations.*—The use of blisters in internal inflammations is very common and very beneficial. The same rules are to control the time of their application as have been so often repeated. The general excitement must be in some degree subdued, the vehemence of inflammatory action checked, else will blisters add fuel to the flame and increase the diseased action they were meant to control. The good they can do is limited to certain stages of the disease and states of the system. To go a little into the consideration of particular inflammations:

1. *Those of the Thoracic Cavities.*—Here blisters show their best powers, and if only the disease has been checked by depletion, or if its original character was not too violent, they will produce great and good results.

2. *In Inflammations of the Abdominal Viscera.*—Here, too, blisters will sometimes produce the best curative effects. An objection to their

use is that they deprive us of the use of pressure as a test of the progress of disease. This is an additional reason for not using them very early.

3. *Inflammation of the Brain.*—Here, too, blisters are, by universal consent, remedies of great value, but a question is raised as to where they should be applied. Some shave and then blister the scalp; others apply the blister to the nape of the neck, or even to more distant parts. I believe the latter is the true practice; from the peculiarities in the cerebral circulation, it is, I think, impossible, or nearly so, to cause determination to the scalp without causing a like determination to the brain itself. Hence the advantage of putting the blister at a distance; and this I believe common experience has sanctioned. The best places are over the stomach, on the back of the neck, along the spine, and upon the extremities. They create a revulsion from the brain, take off the current of blood from the organ, and often produce a most salutary influence on the disease, co-operating markedly with other remedies, as purgatives, &c., &c.

4. *Inflammation of the Veins, or Absorbents in the Extremities.*—In these inflammations the application of a blister along the whole track of the vessel will often produce the most admirable effects.

5. *Inflammation of the Joints.*—Whether the disease be acute or chronic advantage can be derived from blisters. They are best used as successive blisters, allowing one to heal before the other is applied. This practice we owe, I believe, to Dr. Physic of Philadelphia.

USE OF ISSUES AND SETONS IN DISEASE.

From the nature and mode of their operation it is obvious that these revulsives act very little, if at all, as counter-irritants, and mainly as local depletants and derivatives. From the slowness of their action, too, they are unavailable where an immediate impression is required. All these facts look to their employment in chronic cases, and in such mainly are they used. Where the habit is full, this fulness may endanger particular organs, as the brain; the danger can often be warded off, and the current made to set in a different direction, by establishing an issue. Hence their use to prevent apoplexy. In chronic inflammations they are used, I think, less than formerly, practitioners preferring repeated blisters to the action of an issue.

Moxa.—Baron Larrey first used moxas in paralysis, and was very successful; subsequently he and others have used them in various spasmodic affections, and in neuralgia, chronic affections of the abdominal viscera, rachitis, morbus coxarius. By Wallace it was used, and highly commended, in a very wide range of neuralgic, paralytic, and rheumatic affections, epilepsy, and other spasmodic diseases. It has rather lost than gained ground during the last ten years.

ALTERATIVES.

In a certain sense all medicines are alteratives, inasmuch as they produce more or less alteration in the existing state of the system. Common usage has, however, restricted the term to a particular class of medicinal agents. In this restricted application, it is used to designate those remedies which, without causing any very marked or sensible evacuations, act upon the system at large and produce a gradual change in its condition.

Physiological Effects.—If given in a suitable way, these agents generally prove excitant to the digestive organs. The appetite is increased, perspiration promoted, the quantity of urine considerably augmented, and the health improved. If their use be continued beyond a certain period, however, other effects are produced. General excitement comes on, and the specific effects of the individual agents are developed. If their use be still further persisted in, they prove *poisonous.*

In addition to these, the proper alteratives, there are certain other agents which I shall consider under this head, distinguishing them as local alteratives (those which change the vital action of the particular part to which they are applied) and chemical alteratives, or those which produce their curative effects by a chemical change in the various fluids of the body. Under the first of these sub-classes, I shall speak of those agents more commonly called caustics, and under the latter of antacids and antilithics.

Peculiarities of this Class of Agents.—There are some particulars in which alteratives differ from other classes of medicinal agents.

1. They require to be taken in minute doses and repeated at stated intervals. Unless this is done the effect is not obtained.

2. Their use must be continued for a certain length of time. The period required for this purpose varies according to circumstances; but the average for a full course, perhaps, may be put at from two to four months.

Rules to be Observed during their Use.—1. During a course of alterative treatment, particular attention should be paid to the patient's *general mode of living.* As the course of medication through which he has to go is long and debilitating, it is improper to reduce his general powers by a too abstemious diet. On the other hand, care should be taken that all excitement should be avoided. The best general rule is to let him live according to his usual mode, reducing somewhat the quantity of animal

food and interdicting altogether the use of stimulants, whether in the shape of drinks or of high-seasoned food.

2. The *clothing* of the patient should be particularly attended to—as one great object is to keep up an equable action on the skin, so as to secure the general operation of the remedies upon the whole system. Flannel should always be worn next the skin in the winter and spring, and cotton during the warm weather of summer.

3. Frequent recourse should be had during a course of alterative treatment, to the use of the *tepid bath* 92° to 94°. This co-operates very powerfully in determining to the surface, equalizing the circulation, and lessening general irritability.

4. The digestive organs should be specially attended to. In proportion as they are kept in due order will the specific operation of the alterative be obtained.

5. Above all things, in an alterative course (more especially of mercury), it is important to keep the nervous system as free from irritation as possible. For the kindly operation of this agent, the mind as well as body should be kept tranquil.

APPLICATION TO PARTICULAR DISEASES.

The first which I shall notice is:

1. A Disordered Condition of the Digestive Organs.—This, though not known by any particular name in the books of Nosology, is one which you will very frequently meet with in practice, and a due understanding of its nature and its reciprocal relations with the state of the system at large, will enable you to treat successfully many diseases which otherwise might prove altogether unmanageable.

This state of the digestive organs will vary of course in degree. Generally, however, it is characterized by the following symptoms: dimiuution of appetite and impaired digestion; sometimes, however, the appetite will not be materially affected or even excessive; the excretions from the bowels are generally deficient in quantity, of an unnatural color and fœtid. If the tongue be examined, you will find it, particularly at the back part, dry, whitish, or furred. This is most apparent in the morning. The fur extends from the root of the tongue along the middle to the tip, while the edges remain clean. If the disease progresses, a tenderness is now felt in the epigastric region on pressure, and the patient appears to breathe more by the ribs, and less by the diaphragm, than in health. Along with these symptoms, the urine is frequently turbid.

The mind is also frequently irritable and desponding, "anxiety and languor are expressed in the countenance. The pulse is frequent or feeble; and slight exercise produces considerable perspiration and fatigue." At

night there is restlessness, and if patients sleep they awake unrefreshed and in a state of great lassitude. Now this state of things shows not merely a deranged condition of the digestive organs, but also general weakness and irritability of the nervous and muscular systems.

This condition of the system you find frequently in persons who are naturally of a nervous and irritable temperament. You see it also in cases of local irritation implicating the digestive organs, or of general irritation of the nervous system, as in cases of secondary syphilis, etc. The disorder of the digestive organs is then caused by some other general or local irritation in the system; while on the other hand this very disorder may become itself the cause of other diseases—at any rate be so intimately associated, that the removal of the one will generally lead to that of the other.

Treatment.—In attempting to relieve this condition, the principal objects are: 1. To improve the quality and increase the quantity of the secretions from the liver and intestines. 2. To allay the irritability and increase the tone of the digestive organs.

To accomplish the first of these objects, mercurial alteratives are to be used. The best form in which mercury can be given is that of the blue pill, or the plummer's pill. One of these may be taken every other night. Given in this way mercury gently stimulates the liver, increases the flow of bile, and at the same time corrects its quality without irritating the bowels.

For the purpose of ascertaining the true character of the discharges, you must be very minute in your inquiries; you are otherwise exceedingly liable to be deceived. For the purpose of clearing out the bowels, occasionally cathartics are necessary, and of these such are to be selected as will not debilitate either the system or the intestines. With this view it may be well to combine them sometimes with tonics; very good combinations of this kind may be made with rhubarb and colombo, or with senna and infusion of gentian.

Syphilis.—In both forms of syphilis some of the agents belonging to this class are used, and I shall therefore make them the subject of a few remarks. In the primary form of syphilis, besides the local remedies which are required, recourse is generally had to some of the preparations of mercury. Of these the best is the pil. hydrargyri, one to be given night and morning. Generally speaking, if nothing untoward occurs in the case, if the patient submit to proper regimen and diet, in the course of three or four weeks chancres will heal under this management; in many cases in much shorter time.

In the secondary forms of this disease, a more elaborate course is necessary. Here it seems requisite that the system should be subjected for a certain length of time to the slow and alterative effects of a mercurial, to eradicate the disease. For this purpose either *corrosive sublimate* or

plummer's pill is generally selected. These operate mildly on the system, and can be continued a much longer time than most of the other forms of this metal, without producing salivation or irritating the bowels. In addition to this, the most salutary effects are obtained from the simultaneous use of sarsaparilla and other vegetable alteratives. Of these the best are the *decoction of the woods* and the *syrup of Sarsaparilla.* These preparations improve the general health, and have a very salutary influence in correcting the bad effects of mercury.

Scrofula.—In the general management of scrofula an object of great importance is to regulate the condition of the digestive organs. This is to be accomplished by the occasional use of alteratives; more especially will these be found advantageous when the tongue is foul, and other symptoms of gastric and intestinal disorder are present. Of all the remedies the best is *iodine.* As an internal as well as external remedy it has been used with the greatest advantage and success. In using it the general precautions already laid down in relation to it are to be carefully observed. By Dr. Christian *gold* has also been used in scrofulous affections with the greatest success.

INDIVIDUAL ALTERATIVES.

Mercury.—Of the general history of this article I have already given a full account. Of its alterative effects in inflammatory complaints, too, notice has been taken. At present I shall notice it simply as an alterative given in minute doses, with a view to the correction and eradication of certain forms of disease.

Physiological Effects.—When given in minute doses, several of the preparations of mercury produce the most admirable alterative effects, acting gently on the liver, stomach, and small intestines, and augmenting and improving the secretions, correcting digestion, obviating habitual costiveness, increasing appetite, and, as it were, renovating the whole system. If given under proper restrictions, all this may be done without producing any very marked effect in the way of evacuation, &c., the improved general health being the only evidence of their activity. The mercurials given as alteratives are blue pill, pulv. hydrargyri, c. creta, calomel, and corrosive sublimate. Of each of these I have already spoken, and shall only add a few words as to their respective powers, modes of use, and value as alteratives.

Blue Pill.—This is perhaps the most valuable of the mercurial alteratives, mild and manageable, yet sufficiently active. Three grains twice a-day is a full alterative dose; if it purge or produce constitutional irritation, or show a tendency even towards salivation, it should be omitted or the dose much diminished. Combining it with a few grains of Dover powder will

often prevent these bad effects, and sometimes control them when already manifested.

Hydrargyrum cum Creta.—This is a milder preparation than blue pill, but more apt to produce nausea, and less reliable. [It is, however, *the mercurial* for children. Ed.] Dose (for adults) 5 to 8 grs. twice a-day.

Calomel.—This is the favorite Mercurial of very many American practitioners; as an alterative inferior to blue pill, in that it is more apt in very small doses to irritate the bowels, produce purging, and sometimes induce a general constitutional irritation. Dose half a grain twice a-day.

Corrosive Sublimate.—In minute doses this article will produce the good effects of a mercurial alterative, but it is more apt than even calomel to produce constitutional irritation, and that of a less manageable kind. It has an advantage over either of the other preparations of mercury in that it acts more decidedly on the skin and the urinary organs. Opium is said by Bell not to have the same effect in counteracting the irritation of the stomach and bowels produced by corrosive sublimate, as when like effects result from the use of blue pill or calomel. Dose, $\frac{1}{8}$ gr. twice a-day, gradually but cautiously increased.

Plummer's Pill.—This preparation of mercury was first introduced into practice by Dr. Plummer, and from him derives its name. It is a combination of calomel, golden sulphuret of antimony, and gum guiacum, in the proportions of one grain of each of the two first and two of guiac. This pill, though not a great deal used, is a most excellent combination, and in certain cases its effects are unrivalled. Its peculiarities, as differing from simple calomel, are, that it acts more on the skin, and from this circumstance is less likely to act on the salivary glands, or to produce irritation of the bowels. It is, therefore, an excellent article to be used in those constitutions which are too readily salivated by mercury or too liable to be irritated by its operation. From its action on the skin it is peculiarly beneficial in chronic cutaneous affections, and in the secondary form of syphilis, particularly where the skin is affected. The dose is one pill morning and evening.

IODINE.

This is a simple substance, and is one of the numerous and valuable contributions which chemistry has made within a few years to the materia medica. It was accidentally discovered in the year 1812 by M. Courtois, a manufacturer of saltpetre in Paris. In preparing carbonate of soda from the ashes of sea weeds (kelp), he observed that the residual liquor corroded metallic vessels powerfully. On investigating the cause of this he found that sulphuric acid threw down a dark-colored matter, which, by the application of heat, was converted into a beautiful violet vapor. The nature

and properties of this substance were soon afterwards established by Gay-Lussac and Sir Humphrey Davy, and the name of Iodine given to it.

Iodine is found extensively distributed both in the organized and unorganized kingdoms of nature, generally in combination with potassium or sodium. It is found in sea-water, in various mineral springs, and sometimes in combination with some of the metals, such as silver, zinc, and lead. It exists also in sponges, in the oyster, and in various marine molluscous animals. In most of the sea weeds it is also abundant.

Mode of Preparation.—The iodine of medicine and commerce is obtained from *kelp*, which is the ashes of sea weeds. In this it exists in the state of *iodide of potassium, or sodium.* Kelp contains a number of ingredients, such as the chlorides of sodium and potassium, carbonate of soda, sulphates of soda and potash, &c. It is used by the soapmakers for the purpose of obtaining the carbonate of soda. The liquor which remains after this salt is separated, is acted upon by sulphuric acid and the binoxide of manganese. When subjected to heat iodine distils over, and is collected in cool glass receivers. It is then washed with water, and dried between folds of bibulous paper.

Properties.—Iodine is an opaque, soft, friable solid, in scales of a metallic lustre, and of a greyish black color. Its specific gravity is 4.948. Its odor resembles that of a chlorine; its taste is hot and acrid. When rubbed on the skin it stains it yellow. At 120° it is volatilized in the form of beautiful violet-colored vapors, and from this derives its name, from the Greek ιωδης, violet-colored. These vapors being collected, condense again into new flat crystals. In water it is very sparingly soluble, requiring 7000 parts to dissolve it. In alcohol and ether it is readily soluble; with starch it forms a compound of a deep blue color.

Adulteration.—Although iodine is generally pure, yet it sometimes has been found adulterated with charcoal, protoxide of iron, coal, plumbago, &c. These may be detected by the following test: heating it in a glass tube by a spirit-lamp until no more violet vapors escape. If any residuum remains it shows the adulteration. The amount of adulteration may be ascertained by weighing before and after subjecting to heat.

PREPARATIONS.

1. Iodine itself is given in *substance in the form of pill.* This is one of the forms recommended by Brera. It is made by rubbing up iodine with elder root and liquorice powder, each pill containing half a grain of iodine, to be taken night and morning. In this form it is not now used.

Tincture.—This is one of the forms in which iodine has been most used. By Magendie it is directed to be made in the proportion of forty-eight grains to one ounce of alcohol. Of this from five to twenty drops may be

taken three times a day in a small glass of sugar and water, or of any other viscid liquid. Although much used, this is an objectionable form, as it is liable to undergo decomposition, especially when exposed to light. The iodine attracts a portion of the hydrogen of the alcohol, and thus becomes converted into iodurated hydriodic acid. And the objection is, that when taken in an aqueous vehicle, the iodine is precipitated in the solid state, and may thus cause irritation of the stomach. (Lugol.) In using the tincture, a necessary precaution is to have it fresh; when kept for any time the alcohol evaporates, and the iodine is deposited in a crystalline form. The strength of the preparation, too, in this way varies. It should, therefore, be prepared in small quantities, and always kept in tightly-stopped bottles. By Dr. Manson, who used this preparation very extensively, it was made in a different way. He added double the quantity of alcohol to the same quantity of iodine; of this, of course, two drops are equivalent to one of the former. Dr. Manson states that this quantity of alcohol, added in portions and assisted by trituration, was found no more than sufficient to dissolve the iodine, and to keep it permanently suspended. Prepared in this way, he states that he used it for three years, and that he never found any deposition of iodine, or any change in the qualities of the article.

Ointment.—This is prepared by rubbing up ℈i of iodine with an ounce of lard. Of this about a scruple may be rubbed on the part night and morning.

Liniment.—By Dr. Manson, a liniment is recommended for external application, as preferable to the ointment. It is made in the following way:

℞. Tinct. iodini	. . ʒi.	
Linim. sap. comp.	. ℥i.	M.

To be rubbed on the part once or twice a day. Generally the skin will not bear more frequent applications.

COMPOUNDS OF IODINE.

2. Iodide of Potassium.—This is an opaque, white, crystalline salt. It has an acrid and saline taste, somewhat resembling that of common salt. It has no smell; it is soluble in about two thirds of its own weight of water, and in the act of dissolving is converted into the hydriodate of potassa. Its aqueous solution is capable of taking up a large quantity of iodine, and then becomes an ioduretted hydriodate of potassa. It is also readily soluble in alcohol. Iodide of potassium contains one equiv. of iodine 124, and one of potassium 40=164. It contains no water of crystallization. The term hydriodate of potash, therefore, generally applied to this salt is incorrect.

Mode of Preparation.—There are various modes of preparing this salt: one is by adding iron filings to a mixture of iodine and distilled water; this is to be subjected to the action of heat; a solution of carbonate of potash is to be added; this is to be filtered, and the liquor to be evaporated—crystals of iodide of potassium will be formed.

In the first part of this process an iodide of iron is formed in solution. This is decomposed by the carbonate of potash; the carbonate of iron is precipitated, and the iodide of potassium held in solution. By evaporation this is obtained in the form of crystals.

Adulteration.—This salt is said to be extensively adulterated, and as these adulterations change and even destroy the powers of this article as a remedial agent, it is important to be acquainted with them. The impurities most commonly mixed with it are muriate of soda, carbonate of potash, traces of sulphate of soda, &c. To show the extent of these Pereira states, that he analysed a sample of it, which contained seventy-seven per cent. of the carbonate of potash. Dr. Christison analysed another sample, which contained 74·5 per cent. of carbonate of potash, 10 of water, and only 9·5 of iodide of potassium. Dr. O'Shaugnessy analysed another, which contained sixty-four per cent. of the same salt.—Lugol, p. 212.

Tests. 1.—A simple trial test to detect these adulterations, is to add a little acetate of lead to a solution of the suspected specimen; if it be *impure,* a copious white precipitate will be formed; if *pure,* a beautiful golden precipitate will be formed, perfectly soluble in hot water, and which crystallizes on cooling.—Lugol, p. 214.

2. Another test is to add a solution of nitrate of silver to one of the suspected article; if impure, a white precipitate of the carbonate, chloride, and iodide of silver subsides; filter, and when dry, project the precipitate into ammonia, which dissolves the chloride and carbonate of silver, while the iodide remains.—O'Shaugnessy in Lugol, p. 213.

Effects.—Analogous to those of iodine.

Mode of Administration.—The ordinary mode of giving it is in solution with simple water in doses of from five to ten grains to an adult, repeated two or three times a day. By some it has been given in much larger doses.—See Pereira, p. 283.

A more common form of giving it, however, is with iodine in solution; a solution of the iodide of potassium readily dissolves free iodine, and it then forms what is the *ioduretted iodide of potassium.* This is the preparation so highly recommended by Lugol, which he considers as possessing advantages over any other. It is made as follows:

℞.	Iodine . . .	℈i	
	Iodide of potassium .	℈ij	
	Distilled water . .	℥vii	M.

Of this Lugol prescribes six drops twice a day, gradually increasing the dose every week two drops, until it reaches twenty or thirty daily. It is

given in half a glass of sweetened water. For children under seven years of age, two drops twice a day, to be increased gradually to five drops twice. From seven to fourteen, he seldom exceeds sixteen drops daily.—See Lugol, p. 168.

Ointment.—This is made by rubbing up ʒi of iodide of potassium with ℥i of lard. A scruple of iodine rubbed up with this makes the ioduretted ointment.

Another mode of external application is by solutions of various strength. The following are recommended by Lugol as injections:

	No. 1.	No. 2.	No. 3.
℞. Iodine .	grs. ij	grs. iij	grs. iv
Iodine of potas.	grs. iv	grs. vi	grs. viij
Dist. water	℔j	℔j	℔j

These are used in ozena, fistulous sinuses, &c.

Caustic Iodine.—This Lugol prepares thus:

℞. Iodide . . .	℥i.	
Iod. of potas. .	℥i.	
Dist. water .	℥ij	M.

This is used for repressing excessive granulations, &c.

Baths.—This is one of the favorite forms of using this article by Lugol. The following is a tabular view of the mode in which the baths are prepared for children and adults:

BATHS FOR CHILDREN.

Age.	Water.	Iodine.	Iodide of Potassium.
4 to 7	36 quarts.	30 to 36 grs. Troy.	60 to 72 grs. Troy.
7 to 11	75 "	48 to 60–72 "	96–120–144 "
11 to 14	125 "	72 to 96 "	144–192 "

BATHS FOR ADULTS.

Degree.	Water.	Iodine.	Iodide of Potassium.
No. 1.	200 quarts.	2 to 2½ drs. Troy.	4 to 5 drs. Troy.
" 2.	240 "	2–2½–3. "	4–5–6 "
" 3.	300 "	3–3½ "	6–7 "

These baths are generally ordered three times a week. Lugol, p. 180.

3. Iodides of Mercury.—Of these there are two, the *Protiodide* and the *Biniodide*. *Protiodide of Mercury.*—This is never found in nature. It is a greenish yellow powder, without smell, and with a slight metallic

taste. By exposure to light it is decomposed, and its color changed. It is insoluble in water and alcohol, but soluble in ether, and slightly so in an aqueous solution of the iodide of potassium.

Preparation.—It is prepared by rubbing up mercury and iodine in equal proportions, with the addition of a little alcohol, until globules are no longer visible. The alcohol is added to aid the solution of the iodine. It consists of one equiv. of iodine and one of mercury.

Mode of Administration.—The dose of this is from one to two grains daily for adults.

Pill.—This may be made by rubbing up of the Protiodide gr. j., with extract of juniper grs. xii., and liquorice, q. s.; divide into eight pills. Of these two may be taken, night and morning, gradually increasing the dose.

Ether of the Protiodide.—Made by dissolving one part of protiodide in 48 parts of sulphuric ether. Of this from 5 to 20 drops may be taken in distilled water, gradually increasing.

Ointment.—Protiodide ʒ ss., with lard ℥ j.

Biniodide of Mercury.—Like the protiodide this is not found in nature, but prepared artificially. It is a powder of a beautiful scarlet color. It is insoluble in water, but soluble in alcohol, ether, solutions of iodide of potassium, &c. "It combines with other alkaline iodides (as iodide of potassium) forming a class of double salts, called the *Hydrargyro-iodides.*"—Pereira. It is unaffected by the atmosphere, but decomposed by light.

Preparation.—It may be prepared by rubbing up with the addition of alcohol, two parts of iodine, and one of mercury, until globules are no longer visible. It consists of two eq. of iodine and one of mercury.

Mode of Administration.—The dose is $\frac{1}{16}$ to $\frac{1}{4}$ of a grain, night and morning.

Pill.—Made the same as the preceding, or it may be given dissolved in alcohol or ether.

Ointment.—15 grs. to ℥j. of lard.

Effects of the Iodides of Mercury.—Both of the iodides of mercury are powerfully irritant and caustic. The biniodide is nearly as caustic as corrosive sublimate. The protiodide is much milder. They should both, however, be used with caution. Like other mercurials, their continued use causes salivation. Combining the properties of iodine and mercury, they have been used with advantage in cases of syphilis occurring in scrofulous constitutions.

Iodide of Starch.—This is prepared by rubbing up 24 grs. of iodine with a little water, and then adding, gradually, ℥ j. of starch, the trituration to be continued until the compound assumes a uniform blue color. It

is then dried with a gentle heat, so as not to drive off the iodine, and to be kept in well-stopped bottles.

The combination of starch renders the action of the iodine much milder. ℨ ss. of this may be taken three times a day, and increased gradually. Dr. Buchanan has given as much as three ounces in a day.

5. Iodide of Iron.—This is an "opaque iron-grey crystalline mass, with a faint metallic lustre," and an astringent taste. It is volatile, very deliquescent, and very soluble both in water and alcohol. By exposure to the air it attracts oxygen, and "forms sesquioxide of iron."

Preparation.—Made by mixing certain proportions of iodine, water, and pure iron filings, and subjecting them to heat in a sand bath. When it has acquired a greenish color pour off the liquor, and wash the residue with boiling water. The liquors are then to be evaporated, and the salt dried. It contains one eq. of iodine, and one eq. of iron. This preparation combines the tonic effects of iron with the peculiar effects of the iodine, and is accordingly used in all cases where this kind of combination is required, as in chlorosis, asthenic dropsy, chronic visceral engorgements, &c., &c. From its great solubility, it acts with great power on the system.

Dose.—Three to eight grains, two or three times a day, in pill or solution.

5. Iodide of Arsenicum.—This is a solid, of an orange red color, volatile and soluble in water. It is prepared by gently heating in a tubulated retort placed in a sand bath, a mixture of one part of finely pulverized arsenic with three parts of iodine. The iodide is afterwards to be sublimed to separate the excess of arsenic. It consists of $1\frac{1}{2}$ equiv. of iodine, and one eq. of arsenic.—Pereira.

Mode of Administration.—Internally it has been used by Dr. Thomson of London, with success in cases of lepra and impetigo. He began with $\frac{1}{10}$ of a gr., three times a day, increased to $\frac{1}{4}$ of a gr. Beyond this, its use is dangerous.

Ointment.—Iodide of arsenicum grs. iij. lard ℥ j. Used by Biett in phagedenic tubercular disease of the skin.

6. Iodide of Lead.—This is a powder of a beautiful yellow color, partially soluble in acetic acid and in alcohol. In cold water it is insoluble, but perfectly so in boiling water, from which it separates as the solution cools in fine brilliant scales. It consists of one eq. of iodine and one eq. of lead. It is prepared by the reciprocal actions of solutions of iodide of potassium and acetate of lead. Iodide of lead is precipitated and acetate of potash in solution. The precipitate to be washed and dried. Perfect solubility in boiling water is the test of its purity.

Effects.—In its local action on the skin iodide of lead does not appear to

be irritant; internally it is mild, though in some cases it has produced irritation of the stomach and constipation. Its general action is alterative, like iodine. It is used internally and externally in cases of glandular enlargements. Less active than iodine.

Mode of Administration.—One fourth to half a grain twice a day, gradually increased. Ten grains may be given without inconvenience.—(O'Shaugnessy in Lugol.)

Ointment.— ʒj to ℥j of lead.

7. Iodide of Sulphur.—This is a compound of a massy appearance, of a dark color, and a lamellated structure. It is prepared by heating gently four parts of sulphur with one of iodine. Part of the iodine volatilizes, while the remainder unites with the sulphur.—(Pereira.)

It has the peculiar smell of iodine, and stains the skin as it does. If it be boiled in water the iodine volatilizes with the steam, and the sulphur is deposited nearly pure. It consists of 1 eq. of iodine, and 1 q. of sulphur.

Mode of Administration.—Not used internally, only as an external application in the proportion of about ℈j to ℥j of lard.

8. Iodide of Zinc.—This is a white crystalline salt in needles, very deliquescent, and very soluble in water. It has a disagreeable and styptic taste. It is prepared by the joint action of solutions of sulphate of lime and iodide of baryta, filtering and evaporating to dryness, or by subjecting to heat and subliming twenty parts of zinc with 170 iodine.

I am not aware that this has been used internally. It is recommended as an external application for discussing tumors by Dr. Ure, who proposes it as a substitute for the ointment of the iodide of potassium:

Ointment Iod.— ʒj to ℥j lard—a drachm of this to be rubbed on the tumor twice a day.

9. Iodide of Gold.—Of a greenish yellow color, insoluble in cold, but slightly so in boiling water. Heated in a crucible, iodine vapors are given off, and metallic gold is left.

It is prepared by the action of solutions of iodide of potassium, and of chloride of gold. Iodide of gold is precipitated; this is to be collected on a filter, washed with alcohol, to rid it of the excess of iodine which is precipitated with it.

It has been used internally in venereal affections in doses of from $\frac{1}{15}$ to $\frac{1}{10}$ of a grain.—Pereira.

Effects and Uses of Iodine.—When taken in *small* and *repeated* doses, iodine operates like the other agents belonging to this class of alteratives. It alleviates certain diseased conditions without producing any sensible effects on the system. In this way it may be taken for weeks and even months. During this time the functions of the digestive organs are

generally improved, and the appetite is frequently greatly increased. Lugol states that at the Hospital of St. Louis, where this remedy was extensively used, this effect was so decided that the ordinary hospital allowance was not sufficient to satisfy the patients. In many cases this is the only effect produced. In other cases, from its general operation on the secreting and absorbing system, its effects are more visible. Sometimes it proves powerfully diuretic, while in others this is not observed, and sometimes it acts as an emmenagogue, while at others, again, it produces no effect on the uterine organs. On the glandular system effects of a peculiar and striking character have occasionally been noticed. These are a diminution and wasting of the *mammæ* in females, and of the *testicles* in males. Occasionally *salivation* is produced by it. On the adipose tissue its effect varies; sometimes it occasions emaciation, while in others a contrary effect is produced. According to Lugol it always increases the growth and size of the body.

There can be no question that iodine acts on the whole system of capillary vessels, exciting, under different conditions of the system, sometimes one organ and sometimes another.

If the use of iodine be persisted in too long, it affects the system like a *poison*. In some cases the stomach and bowels become disordered, there is vomiting and purging accompanied with general excitement and disturbance of the system. In other cases the nervous system is assailed by tremors; general prostration, loss of appetite, and emaciation are the prominent symptoms.

DISEASES IN WHICH IODINE HAS BEEN USED.

1. Bronchocele.—This was the disease in which iodine was first used, and it is to Dr. Coindet, of Geneva, that we are indebted for its first introduction into practice. It was originally suggested to this physician by his reflecting on the fact that iodine had been discovered in the sponge, an article which in the form of *burnt sponge* had long held a high reputation among the vulgar as well as among physicians, as a cure for bronchocele, and from this circumstance he was induced to suspect that the virtues of the sponge depended upon the presence of iodine.* Living in a district of country where this disease prevails extensively, he had immediate opportunities of putting his suggestions to the test of actual experiment, and was speedily gratified by obtaining the most decisive proofs of its efficacy. Immediately on the annunciation of the beneficial effects of iodine in this disease, experiments were made with it by practitioners in various parts of Europe, all of whom concurred in celebrating its virtues. In this country it was tried, and with equal success. From the extensive experience which

* Memoir de M. Coindet in Bayle's His., vol. i. p. 6.

we have thus had of this remedy, we are now able to form an impartial opinion in relation to its real virtues. Although not a specific in this disease, as it was first supposed, yet it exercises a wonderful control over it, and such as no other medicine is capable of. Bayle has made a summary of the cases treated by a number of physicians, and as the result he states that of 354—there were 264 cases of goitre cured.*

2. SCROFULA.—This is another disease in which this remedy has been peculiarly successful, and it is to Dr. Coindet that we are also indebted for suggesting its use here.† Since then it has been used by different physicians, but by none so extensively or successfully as Lugol of Paris. It appears that during seventeen months, 109 scrofulous patients were treated with iodine alone, at the Hospital St. Louis, of which 61 were males and 48 females. Of these, 39 (29 males, 10 females) were still under treatment at the time of the report; that 30 (17 males, 13 females) had left the Hospital much improved; that in four cases (2 males and 2 females), the treatment was ineffectual; and, that 36 (13 males and 23 females) were completely cured.‡ By Lugol the iodine is used both internally and externally, and, what is new in his practice, in the form of baths, to which he attaches the greatest efficacy.

3. CHRONIC ENLARGEMENTS OF THE VISCERA.—In enlargements of the liver, spleen, mammæ, testicles, and ovaria, iodine has been used with great advantage.

4. DROPSIES.—In some cases of ascites, I have used iodine with the happiest effects. By Dr. Thomson three cases of ovarian dropsy are stated to have been cured by the internal and external use of this agent.§

5. As an *emmenagogue*, iodine is particularly spoken of by Coindet and others. In several cases, I have witnessed its effects on the uterine organs. Magendie states that he gave it in a case represented to be one of suppressed menstruation, and in three weeks abortion was the result.‖

6. NERVOUS DISEASES.—In eleven cases of *chorea* it was used by Dr. Munson with success. By the same physician it was also used with advantage in cases of *paralysis*, arising from tumors or fluids pressing on the brain or spinal marrow, or from morbid thickening of the investing membrane of the cord itself.

7. DISEASES OF THE SKIN.—Where, as is very common, diseases of the

* Therapeutique, vol. i. p. 194. † Ibid., p. 25.
‡ Lugol on iodine. Translanted by O'Shaugnessy, p. 8.
§ Mat. Med. vol. i., p. 346. ‖ Bayle, pp. 10, 195.

skin are connected with, if not dependent on, scrofula, iodine may be used with the greatest advantage. Chronic cases, of eczema in particular, yield to it promptly.

8. Lastly. In *syphilitic diseases* it has recently been used, and with apparent advantage; also to arrest salivation.

Gold.—This metal is found in almost every part of the world, and only in the metallic state, either alone or alloyed, with other metals. It is of an orange yellow color, and exceeds all other metals in malleability and ductility. Exposure to air and moisture for any length of time produces no change in it. It is not oxidyzed or dissolved by any of the pure acids. Its only solvents are *chlorine* and *nitro-muriatic acid.* According to Sir H. Davy, the agent in both cases is the chlorine.

Physiological Effects.—When taken in *small* and *continued doses*, this article operates like most of those belonging to this class. It gently stimulates the digestive organs and improves the appetite, at the same time that it moderately excites the pulse. The only marked and sensible effect, however, which is produced is that of increasing perspiration and the flow of urine. This latter it does uniformly and to a very decided extent.* If it be given in *larger quantities*, it produces a general febrile excitement of the system, accompanied with an universal heat of skin. The bowels are generally constipated. In some cases there is dryness of the mouth and throat. The gums become affected and salivation ensues. According to M. Niel, the salivation produced by gold differs from that of mercury in many important respects. It is always mild—never producing the severe irritation and inflammation of the gums and mouth which so frequently accompany mercurial salivation. It is less protracted in its duration, and is unattended by the disgusting fœtor of mercurial salivation. The salivary discharge is thin, appearing to be a simple increase in quantity of saliva, a little inspissated, and differing entirely from the thick and viscid secretions which adhere to and corrode the mouth and gums in mercurial salivation. The salivation from gold never interferes with mastication or deglutition, and is never so troublesome as to prevent the person from attending to his ordinary business. The tone of the digestive organs is invigorated and the appetite improved by it.

PREPARATIONS OF GOLD.

1. In the state of metal, gold, like the other pure metals, is generally supposed not to produce any effect on the system. This, however, does not appear to be well established. By Chrestien and others it has been

* Niel, p. 59. Delafield Med. Rep. v. ix., p. 182.

used, and is said to produce the same effects as the salts of gold. It has been used in the form of filings (*limatura auri*) and of powder (*pulvis auri*).

The *limatura auri* is made by filing gold with a fine file. The *pulvis auri* may be prepared by rubbing gold leaf with sulphate of potash, then sifting and washing with boiling water to remove the sulphate.—(Pereira.)

This is supposed to be the mildest of the preparations of gold, but equally efficacious, though more slow in producing its effects.

It is given in doses of from a quarter to one grain three or four times a day in pill or powder.

2. Chloride of Gold.—This is prepared by dissolving by the aid of heat, one part of gold in three parts of nitro-hydrochloric acid.* The solution is to be evaporated until vapors of chlorine begin to be perceived, and then suffered to crystallize. The rationale of this is the following:—The nitric acid parts with a portion of its oxygen, and is given off in the form of nitrous acid. The oxygen unites with hydrogen of the hydrochloric acid, while the chlorine unites with the gold. The evolution of chlorine shows that the newly-formed chloride is beginning to be decomposed.

This salt is in small crystalline needles, of an orange red color, without smell, and of a strong, styptic, acid taste. It is readily soluble in water, alcohol, and ether. When subjected to heat, chlorine is evolved, and it is converted first into protochloride and then into metallic gold. It consists of 1 eq. of gold and 3 eq. of chlorine. It is, therefore, a *terchloride of gold.*

Effects.—This is a very active preparation, resembling somewhat corrosive sublimate. It requires, therefore, to be given in small quantities and with caution.

Dose.—One twentieth to one eighth of a grain once or twice a day, made up into pills with starch, or in solution with distilled water.

3. Chloride of Gold and Sodium.—This is prepared by dissolving eighty-five parts of chloride of gold to sixteen of chloride of sodium in distilled water. The solution is to be evaporated by a gentle heat until a pellicle forms, and then set by to crystallize.—(Pereira.)

It consists of large quadrangular prisms, of a beautiful yellow color. They are soluble in water, and consist of 1 eq. of chloride of gold and 1 of chloride of sodium and 4 of water.

This is a milder preparation of gold than the preceding. It is, also, less expensive, and is, therefore, the most used of any of the preparations of this metal.

* *Aqua Regia.*—One part of nitric and two hydrochloric acid.

It is given in the same doses as the chloride.

4. Oxide of Gold.—"This is prepared by boiling four parts of calcined magnesia with one part of chloride of gold and forty parts of water. Then wash, first with water, to remove the chloride of magnesium, afterwards with dilute nitric acid, to dissolve the excess of magnesia."—(Pereira.)

The oxide of gold is of a brown color, in the form of hydrate, reddish yellow, insoluble in water, but soluble in hydrochloric acid. It consists of 3 eq. oxygen and 1 eq. of gold. It is, therefore, a *teroxide* of gold.

It is given in pills in doses of one tenth of a grain to one grain a day.

With regard to the use of the salts of gold, it is important to remark that there are certain objections to their internal use. In the first place they are very active, and sometimes cause a good deal of local irritation in the stomach. In the second place, they are very readily decomposed by a great variety of substances, and thus lose their activity. "According to Proust, there are few vegetable juices, acids, gums, sugars, &c., which may not have the property of deoxidizing gold."—(Magendie, p. 125.) To obviate this, the ordinary method is to rub them on the gums. In this way all the effects are obtained precisely as when taken into the stomach. The best preparation is the chloride of gold and sodium. This is triturated with ten or twelve times its weight of starch, or powder of lycopodium, and then to be rubbed once a day on the tongue and gums.

In cases where the state of the tongue and mouth does not permit frictions to be made on them, it may be applied endermically. For this purpose the skin is removed by a small blister on the side of the neck, and the following ointment applied:—

℞. Gold minutely divided, gr. j.
Lard, . . ℥ss. M.

Or,

℞. Chloride of gold and sodium, $\frac{1}{10}$th gr.
Lard . . . . ℥ss. M.

See Magendie, p. 126.

DISEASES IN WHICH GOLD IS USED.

1. Syphilis.—This is the disease in which gold was specially recommended by Dr. Chrestien, as a substitute for mercury. This interesting fact was announced in a work which appeared in the year 1811, * in which a number of cases are reported in which it proved successful. According to the representations contained in this work, it would appear that gold is capable of curing syphilis under all its forms, and that in its general

* De la Methode Iatraleptique, etc., par J. A. Chrestien. Paris, 1811.

operation on the system it possesses many advantages over mercury. It is efficacious, yet gentle. It may be administered with perfect safety at any season of the year, and under any complication of the disease. Persons of either sex may be put upon it with equal safety. The only precaution which he enjoins during its use, is the observance of strict temperance. In other respects, the patient is not required to change his accustomed mode of living. Very shortly after the appearance of this work our distinguished countryman, Dr. Samuel L. Mitchill, made the medical public in this country acquainted with its contents, and immediately commenced a series of experiments with gold in the New York Hospital. The result of his experience is contained in the following letter to the late Dr. Dyckman: "The efficacy of the medicine has been tried year after year in the New York Hospital. My practice with it there has been witnessed by all the attendants of the wards. It possesses admirable virtues against syphilis. Without presuming to affirm that it is capable of eradicating the distemper in every instance, my opinion, upon the whole, is that the muriate of gold will effect all that is achieved by the muriate of quicksilver, with incomparably less inconvenience to the patient. He gets well under the operation of the former without the hazard of a sore mouth or a salivation, and with very little wear and tear of constitution. I consider the introduction of this preparation into common use as one of the greatest improvements in modern medicine; and I wish it was already as universal as the malady it is intended to remove. The muriate of gold is found to increase the quantity of urine, in many instances to such a degree that it ought to be ranked among the diuretics of the materia medica."* In 1812, Dr. J. C. Cheesman, of this city, published an inaugural dissertation, in which are detailed a number of cases of primary syphilis which had been successfully treated by this remedy in the New York Hospital.† In 1816 its use was again revived in that institution, and in 1817 a report was published by Drs. J. K. Rodgers and Delafield, containing an account of 81 cases of syphilis successfully treated by the same remedy. The results of all this experience at the New York Hospital seem to be then:

1. That in the treatment of primary syphilis, the muriate of gold possesses powers fully equal to those of mercury.

2. In cases cured by gold secondary symptoms did not supervene more frequently than in cases which have been cured by mercury.

3. In secondary syphilis gold is not to be depended upon for a radical cure.

Never having used the gold myself, I can add nothing from my own experience in relation to it. Although not much used at present, there

* Duncan's Edinburgh Dispensatory, edited by Dyckman.

† New York Med. Rep., vol. xix. p. 180.

are still physicians in our city who are in the habit of using it, and who rely upon it with great confidence.

2. Scrofulous Affections.—Several cases of this kind are recorded by Chrestien as having been cured by the use of gold.* Similar cases have also been reported by Niel.

3. Goitre.—By both Chrestien and Niel cases of this disease are stated to have yielded under the use of this remedy.

4. Dropsy.—From the decided effects of gold in promoting the flow of urine, it has been used in this form of disease, and in some cases it has proved successful. The late Dr. J. Low of Albany relates that he tried it in a well marked case of ascites, and that it "was attended by the best effects."

[Oleum Jecoris Aselli (*Cod Liver Oil*).—This oil, which has of late years gained so much celebrity, is obtained from the livers of various species of the genus *Gadus*, especially the *G. Morrhua*, *G. Molva*, *G. Carbonares.* It is, however, probable that much of the oil of commerce is obtained from other species, or indeed from species of other genera, especially the *Raia.* Three species of oil are spoken of, the *brown*, the *light brown*, and the *pale*, or *yellow*. These varieties do not depend upon the species of cod used, but upon the manner in which the oil is obtained. If the livers are, as is often done, thrown into a tub with a perforated bottom, and the oil which runs spontaneously from them promptly collected and skimmed or strained, it is pale; if this is allowed to remain on the livers till they become putrid, or the oil is kept in a wet place, if due care is not taken in its preparation or preservation, it takes a darker hue, and then we have the light brown oil. When after the pale oil has run off, the livers are boiled in iron pots for from twelve to twenty hours, an oil is obtained of a dark color, rank unpleasant smell and nauseous taste; this is the *brown oil.*

Physical Properties of Pale Oil.—Fluid at ordinary temperatures, of a bright yellow or golden color; fishy taste more or less strong, and a smell resembling in the very pale qualities that of freshly-boiled cod, but stronger. Between this and the dark brown oil there is every shade of difference in color, and every degree of rank fishiness in the taste and smell. The pale oils have generally the consistence of olive oil, and are clear; the browner are thicker and more or less turbid. There is a very great difference of opinion as to the relative merits of the varieties of oil. The Germans, who of late years have used the oil most freely, prefer the darker kinds; in England and in this country, the paler are preferred; and it is confi-

* Methode Iatraleptique.

dently asserted that the oil can be deprived of its most offensive properties of smell and taste, and yet retain its remedial powers.

Chemical Analysis.—Cod liver oil is composed of neutral fat, biliary matter, iodine, phosphorus, butyric, and acetic acid, a peculiar substance discovered by De Jough, and by him called Gaduine, with several organic salts and acids in small proportion. These ingredients exist in the varieties of oil in varying proportions. The pale oils contain most iodine and inorganic salts, while the darker sorts have most biliary matter, butyric, and acetic acid.

Effects on the System.—Cod liver oil does not produce marked sensible effects with any constancy. Sometimes it offends the stomach, causing nausea or even vomiting. In some rather rare cases, it purges; in a few cases it has increased the flow of urine, or the perspiration, but generally it affects none of the secretions.

No effect can be expected from it as a general rule, unless its use be continued for a considerable time; say on an average three to four months.

Use in Disease.—The use of cod liver oil, though now a fashion, is by no means a strictly new thing. The oil was used nearly a century ago by Percival and Bardsley, in England; and in Germany it has been a popular remedy for a still longer period. The attention of the profession was again directed to it about thirty years ago, by several German physicians, who published in rapid succession histories of cures effected by cod liver oil in rheumatism, gout, scrofula, in all its varieties, and finally in phthisis pulmonalis. From Germany the practice passed into France and England, and has been adopted in both countries. In England the oil has been highly appreciated by Dr. J. Hughes Bennet, and most extravagantly lauded by Dr. Williams. But amid all the laudation and enthusiasm which the new remedy has excited, not a few have declared it of little value, and a still greater number have confessed that enlarged experience has very much moderated their expectations of benefit from it. The disease in which it was first used by Schenk, in Germany, was *rheumatism.* He reported a large number of cases of chronic inflammatory rheumatism, in which its use produced the best effects. Subsequent observations have, to a certain extent, confirmed the views of Schenk. The forms of rheumatism in which it was first likely to do good are those in broken-down habits; those depending on imperfect digestion, and those occurring in scrofulous subjects.

Gout.—In this disease the oil has been given a good deal, but not with the same amount of success as in rheumatism.

Scrofula. The Scrofulous Diathesis.—Here it is that cod liver oil has gained most of its reputation, and by many it is still considered almost a specific.

Now that the steady and pretty long-continued use of the remedy has,

in very many cases, produced the most admirable effects, cannot be doubted, and it seems to do this chiefly by its influence in correcting various derangements of secondary assimilation. Whether this change is effected by supplying to the digestive organs a material with which they can repair the various results of defective nutrition, or whether it is by giving to the digestive function power to perfect the assimilation of food taken, is by no means easy to say. Be this as it may, in very many of these cases, whether of caries, of scrofulous ophthalmia, of tabes mesenterica, or tubercular peritonitis, or of various diseases of the skin, connected more or less closely with scrofula, as eczema, herpes, and some forms of impetigo, it has produced excellent effects. Under its use the constitution in general seems to gain vigor, the complexion is clearer, the eye more lively, the mind cheerful, the strength improved, and a remarkable tendency to the deposit of fat shows itself. While the change in the natural functions is going on, as manifested by the general improvement in the aspect of the patient, the disease frequently gives way; chronic ulcerations heal, enlarged glands diminish in size, chronic eruptions disappear, the scrofulous ophthalmia is relieved.

Phthisis Pulmonalis.—In this disease the oil has been used, and by some of its vehement admirers it is said to be equally beneficial in every shape. This is not, however, the common opinion; generally the best effects were found to follow its use in the early stage, where the tubercles had not yet begun to soften, or where the process had but begun. Here the use of the oil has in very many cases been followed pretty promptly by diminution of the expectoration, disappearance of the night sweats, and by very marked increase in size, not occasioned by the mere deposition of the fat, but also by an augmentation of the size of the muscles and a proportionate increase of muscular power. In some cases this improvement has been persistent, and the proportion of such cases, where the dis ease was in its early stage, has been large. In phthisis, with softening, after the formation of cavities, though the relief for a time has been very decided, the night sweats ceasing, the cough becoming freer, and the expectoration less profuse, in some cases, too, flesh and strength being regained in a most remarkable degree, yet this apparent cure has only amounted to an arrest of the disease for a time. In a few months the symptoms return, and the fatal event, though postponed, is not prevented. Such and so great are the advantages which some of the most eminent men among our contemporaries think they have observed from the use of this agent in that most dreadful of all diseases, phthisis pulmonalis. Is there, then, hope that this terrible scourge is to be at last subdued? Will it finally acknowledge the curative power of medicine? We may *hope*, but cannot yet confidently *believe*. In the meantime, what is our duty to our patients and our profession? Try this remedy fairly, but carefully. Let us ascertain if possible what are the circumstances under which it is most likely to do

good; what are the cases most likely to be benefited by it; what are the states of system which contraindicate its uses; what cases are likely to be injured by it. These most important questions are all yet to be settled. On no one of them is our present knowledge at all what it must be before cod liver oil can be given in any other way than empirically. It is generally supposed that a state of plethora, of active irritation, of general or local inflammation, or of great nervous irritability, contraindicate the use of this oil. On the other hand, it is believed most likely to succeed in those patients who are of sluggish, apathetic habit of body, and those most deeply and most fully tainted with scrofula.

Modes of Administration.—Although many modes of covering and disguising the smell and taste of this nauseous oil have been proposed, yet none have availed anything. It can best be taken either alone or floating on some aromatic water. The dose at first should be small, say a teaspoonful thrice a day; never to be taken on an empty stomach, which it is almost sure to offend, but usually about one or two hours after meals. As the stomach becomes reconciled to it, the dose may be increased to an ounce three or four times a day. By Mr. Emery so much as a pint, and in some cases a pint and a half, was given in cases of lepra every day; and the result, he reports, is most encouraging, some very protracted cases being entirely cured by it. Such doses are rarely necessary, and very rarely could patients be persuaded to swallow them. Sometimes, when the stomach rejects the oil, if it is omitted for a few days or weeks, and then given, it will be retained.—Editor.]

Sarsaparilla.—This is the root of a number of species belonging to the genus Smilax. It has generally been supposed to be a product of the *Smilax sarsaparilla.* It is doubtful, however, whether any of the sarsaparilla of commerce is obtained from this source. The species which are now supposed to yield it are the *Smilax officinalis*, *Smilax medica*, and the *Smilax syphilitica.*

These grow in Mexico, Guatemala, and the warm regions of South America.

The smilax is perennial, and has a climbing or trailing stem, beset with prickles. The name *sarsaparslla* is said to be "derived from two Spanish words which signify a small thorny vine."—U. S. Disp.

The part used in medicine is the *roots*, which consist of long and slender runners issuing from a common head with the stem. These runners are the preferable part.

As found in the market, they come in bundles from about two to four feet long. They are about the thickness of a common quill, cylindrical, and with longitudinal fibres, and with more or less radical fibres upon them. They consist of a thick cortical part covered with an epidermis which can easily be separated; a thin inner layer of woody fibre, and a central

medulla or pith. The color of the exterior varies from red to brown and grey. In the dry state they have no smell; on boiling the smell becomes decided. The taste is mucilaginous, and if chewed for a little time decidedly acrid.

Varieties of Sarsaparilla.—The principal varieties of this drug in the market are the following:

1. The *Lisbon* or *Brazilian* sarsaparilla. This is the product of the Brazils, and until of late years found its way to the different parts of the world through the port of Lisbon. Hence its name. It is supposed to be the root of the *Smilax syphilitica.* This kind of sarsaparilla is of a reddish brown color, and abounds in amylaceous matter, both in the bark and pith.

2. The *Jamaica Sarsaparilla.* Supposed to be the product of the *Smilax officinalis.* It comes from the Bay of Honduras, and derives its name from its being brought to England from Jamaica. It is distinguished by its reddish color, from whence it is called the *red sarsaparilla.* It has moreradical fibres attached to it than the preceding. Contains but little amylaceous matter.

3. *Honduras Sarsaparilla.*—This comes from the Bay of Honduras, and is of a dirty or greyish brown color. It has very few fibres attached to it. Under the epidermis is a thick amylaceous layer, which gives it a *mealy appearance;* hence called *mealy* sarsaparilla.

4. *Vera Cruz Sarsaparilla.*—This is supposed to be the product of the *Smilax medica.* It comes from Mexico. This has very few fibres attached —of a light greyish color. It is more fibrous than the other varieties, and contains no starch.

Tests of the Quality.—The best test of the quality of sarsaparilla is the *taste.* The more nauseous and acrid this is, the better. In addition to this, the roots which have a *red color*, and have the greatest number of root fibres, are considered the best. The quantity of starch contained in them, so far from being a proof of goodness, is perhaps the reverse.

Effects.—Sarsaparilla does not produce any direct and sensible effects on the system with constancy. Sometimes it is diaphoretic, again diuretic; in very large doses it irritates the stomach, and is said to produce vertigo. In medicinal doses it acts as an alterative merely, improves the appetite, strengthens the digestion, and invigorates the whole system. It is given with advantage in secondary and tertiary venereal diseases, especially where the system has been broken down by the disease and the abuse of mercury. In these cases it is usually united with stimulating diaphoretics, as mezereon, sassafras, &c. In chronic rheumatism, not connected with syphilis, it often does good; so, too, in chronic diseases of the skin, especially if they occur in broken-down constitutions.

Mode of Administration.—Sarsaparilla is always given in decoction, and usually united with guaiac, mezereon, and sassafras.

Mezereon.—The tree which yields this is the *Daphne Mezereon*, growing wild in England and the north of Europe. It is a very hardy plant, growing to the height of four or five feet. The *bark of the root* is the part used in medicine, the ligneous part being wholly inert. The proper season for digging up the roots is the autumn, after the leaves have fallen. By Vauquelin, a peculiar principle has been discovered in the mezereon, to which he has given the name of *Daphnin*.

Mezereon is a *powerfully stimulating diaphoretic*, exciting the action of the *vascular system*, and acting also on the *bowels and urinary organs*. If given too freely it causes nausea, vomiting, and purging. In its general operation, therefore, it is much more active than either guaiac or sarsaparilla. In substance the dose of this article is from five to ten grains. It is seldom used in this way, however. The best form is that of *decoction*. This is made by boiling ℥ ij of the mezereon with ʒ ss of liquorice root in lbs iij of water down to a quart. Of this four or five ounces may be given three or four times a day.

Even thus, however, it is at present seldom used alone.

Sassafras.—This is the *Laurus Sassafras*, a plant growing in great abundance throughout the United States. It grows frequently to the height of thirty or forty feet, and even more. The wood, root, and bark, are all used in medicine. Its active properties are extracted both by alcohol and water.

Sassafras is a *stimulating diaphoretic and diuretic*, and is used in the same cases with the preceding articles. The best form of giving it is the *infusion*, as decoction dissipates the oil. In this way it is much used as a common domestic remedy. The *oil* is also a good preparation in doses of gtt. ij to iv, rubbed up with sugar and water—seldom used, however.

Guaiac.—The tree which yields the Guaiac is the *Guaiacum Officinale*, a native of Jamaica and South America, rising generally to the height of forty feet. Every part of this tree possesses medicinal properties, but the *wood* and a *peculiar substance*, guaiacum, afforded by it are the only parts used. This peculiar substance exudes spontaneously from the trunk of the tree in the form of tears, or from incisions made into the trunk. From these it flows out very copiously, and is concreted by the sun. Formerly this was supposed to be a *gum resin*, but Mr. Brande declared it a substance *sui generis*, differing both from gum and resin. "Its most remarkable property," according to him, "is the change of color which it undergoes when subjected to oxygenating agents." When reduced to powder its tint is pale grey, but by exposure to air and light it soon becomes of a dingy green. It is now considered a peculiar resin.—Pereira.

It is upon this substance that the virtues of the guaiac wood entirely depend. The *guaiac wood* comes in large, solid, and heavy pieces, of a

yellow color, having but little smell, and a slightly warm, subacid taste. When used for medicinal purposes it is rasped. The *guaiac resin* is sometimes found in the form of tears, but generally in large fused masses "with little smell and taste, brittle and semi-transparent, and of a greenish brown color."—Brande.

"The sensible effects of the guaiac are a grateful sense of warmth in the stomach, dryness of the mouth, and thirst, with a copious flow of sweat, if the body be kept externally warm, or if the guaiac be united with opium and antimonials; but when the body is freely exposed, instead of producing diaphoresis, it augments considerably the secretion of urine."—Thomson's Disp.

Guaiac is a *warm, stimulating diaphoretic*, and has been much used as an alterative remedy in cases of secondary syphilis, cutaneous affections, and the like. It was originally employed by the native Indians of St. Domingo as an antidote to the lues venerea. It was from them that the Spaniards became acquainted with its virtues, and in the year 1508 it was introduced into Spain. It speedily gained great celebrity throughout Europe, and until the last century continued to enjoy so high a reputation as a specific against the venereal that it was called the *lignum sanctum*. More accurate observation has, however, decided that it possesses no such powers. It nevertheless exercises some control over the venereal virus, and in cases where the skin becomes affected with ulcers and blotches it is a remedy of great value, when used in combination with some of the mercurial preparations. For the purpose of producing the greatest sudorific effect from the guaiac, the body should be kept warm, and the guaiac should be combined either with opium or antimonials. If the patient be freely exposed, it is apt to run off by the kidneys instead of producing diaphoresis.

The gum guaiac may be given either in *substance*, in doses of from grs. x. to ʒ ss., in pill or bolus, or what is better, made into an emulsion with water, by means of gum arabic or the yolk of an egg. If given in larger doses it is apt to produce a purgative effect.

An excellent preparation of it is the *ammoniated tincture*, or, as it is commonly called, the *volatile tincture of guaiac*. This is made by a combination of powdered gum guaiac with the aromatic spirit of ammonia. Of this the dose is one or two teaspoonfuls, two or three times a day. Water decomposes it, and therefore it should be given saturated with some viscid substance. This is an admirable stimulating diaphoretic, and may be used with the greatest advantage in cases of chronic rheumatism. It possesses over the guaiac alone the advantage of a combination of the ammonia, which co-operates powerfully as a stimulating diaphoretic.

LOCAL ALTERATIVES.

By these I mean those agents which possess the power of altering the condition of the part to which they are applied, in such way as to remove diseased action. They are the agents usually described under the names of caustics and escharotics. These terms, however, are objectionable, as they are calculated to convey erroneous notions in relation to the effects and operation of many of the articles belonging to this class. This will be abundantly obvious, when we come to consider them in detail.

Nitrate of Silver.—Of all the local alteratives this is by far the most valuable, and exerts a most astonishing influence in changing the condition of the parts to which it is applied. When used in the form of the solid stick, its effects differ, of course, according to the mode of applying it. If lightly rubbed over the skin, previously moistened, or over the surface of a wound or ulcer, it first induces a white film, which, when exposed to the air for a few hours, assumes a darker color, and finally becomes dark grey or black. As it undergoes these changes of color, it gradually becomes harder, and forms an eschar resembling black sticking plaster. In the course of a few days the eschar becomes corrugated and begins to separate at its edges, and at length peels off altogether. Here the nitrate of silver makes a chemical union with the albumen of the skin forming the white film. This becomes gradually hardened, and the change of color is owing to the partial reduction of the silver.

Again, if the skin be moistened, and a stick of nitrate of silver be rubbed lightly over it five or six times, vesication takes place. In the course of four or five days the blackened and separated cuticle falls off and the part heals.

Again, if rubbed repeatedly on a part it acts as a caustic, destroying its texture. When applied to mucous membranes, it forms a thick white compound with the animal matter of the mucus. This protects the part underneath from the caustic effects of the silver, so that the effect is by no means so violent as it would seem. Simply stated these are the effects of the local application of this agent, and it is upon these that it is used in a great variety of affections with the most singular success.

When applied to the external surface, the best form in which to use it is that of solid stick. When applied to mucous membranes, the solution generally answers.

1. *In cases of External Inflammation.*—That nitrate of silver, locally applied, has the power of arresting inflammation, was first noticed by Dr. Higginbottom, who has written an invaluable treatise on the effects and uses of this agent. The mode of applying it is the following: the part is first to be washed with soap and water, and then dried. The inflamed and surrounding part is then to be moistened, and a long stick of nitrate of

silver is to be passed over the moistened surface, taking care that not only every part of the inflamed skin be touched, but also the surrounding healthy skin to the extent of an inch or more. The number of times the stick is to be passed over the inflamed surface depends upon the degree of inflammation present. In some cases simply blackening the skin will be sufficient, while in others actual vesication may be necessary. In very slight cases, accordingly, passing the stick once over the part will be sufficient. In ordinary cases, two or three times will be necessary, while, as vesication is required, it must be applied more frequently.

DISEASES IN WHICH THE NITRATE OF SILVER IS USED.

These are various, and require to be noticed in detail, as in many of them a difference in the mode of applying is necessary.

1. Phlegmon.—In cases of ordinary phlegmon, simply moistening the part and rubbing it over with a stick of nitrate of silver, will sometimes have the effect of arresting the progress of inflammation, without any other application.

2. Paronychia—*Whitlow.*—In cases of this kind, frequently the best application to the part is nitrate of silver, first moistening the surface and then rubbing the stick once or twice over it. In case suppuration should have actually taken place, the best plan is to open the abscess, then applying the nitrate freely within the cavity, and afterwards cover the whole with a cold bread poultice. In most cases this will entirely relieve the pain and irritation, after the immediate smarting of the application has subsided. Should the inflammation be increased in a day or two, as it sometimes is, the application may be renewed.

3. Erysipelas.—There is perhaps no disease in which the effects of the local application of the nitrate of silver are so striking as in this. For the first suggestion of it, I believe, we are indebted to Mr. Higginbottom, who has detailed some very interesting cases, in which it was used with success. As you all know, this disease is not always purely local. It is connected with constitutional derangement requiring general treatment. Blood-letting, purging, antimonials, etc., are of course to be first resorted to. If these should fail to arrest the disease, the best mode is first to moisten the whole inflamed surface and then pass a long stick of the nitrate over every part of it, extending the application a little distance beyond on the surrounding healthy skin. Strange as it may be, the progress of inflammation appears to be immediately arrested, and in the course of two or three days frequently every appearance of inflammation will have disappeared. In about five or six days, the eschar separates.

4. Inflammation of Absorbents.—In cases of this kind, which frequently are so painful and dangerous, there is nothing so prompt and efficient as the local application of this remedy. Generally speaking, inflammation of this sort arises from some local injury extending in the extremities to the axilla and groin. In such cases the best plan is to rub the nitrate not merely over the part first affected, but over the whole course of the inflamed absorbents.

5. Punctured Wounds.—These are attended not unfrequently with the most serious and even fatal consequences. In the slighter of these the effects of the application of the nitrate are really astonishing, in arresting the inflammation and entirely curing the injury. In these cases all that is necessary to be done is to moisten the part first and then pass a stick of the nitrate to the wound, and to pass it once or twice over the whole inflamed part, extending it about an inch beyond on the healthy skin. Generally nothing else is necessary. Where the case has been neglected and matter has already formed, the matter is to be evacuated and the nitrate applied within the cavity. A cold poultice is then to be applied. In two or three days the application may be renewed, in case there should still be any swelling or inflammation left. In this way, ordinary *wounds from instruments*, etc., *the bites of animals, inflamed leech bites, and wounds received in dissection*, may be treated.

Where the punctured wound has been extensive, a good way of treating it is to apply the nitrate first and then bring the edges together by adhesive plaster. In this way the excessive inflammation and suppuration which frequently attend these cases are kept down, and the part heals nearly as by the first intention.

6. Bruised Wounds.—In these cases, whether of simple bruised wounds, or of the more severe kind, accompanied with inflammation or followed by sloughs, the application of the nitrate is attended with the same salutary effects as in punctured wounds.

7. Ulcers.—In the treatment of these intractable cases, the nitrate of silver proves an invaluable remedy. In small ulcers, simply applying it to the surface and a little on the surrounding skin, and after this covering the whole with gold-beater's skin, is all that is necessary.

In large ulcers with inflammation, or in old ulcers, the treatment is the following: first apply a bread and milk poultice over the ulcer, and let the patient keep his bed for 18 or 24 hours. All the inflamed parts are then to be well washed with soap and water and wiped dry. They are then to be moistened with water, and a long stick of the nitrate is to be passed all over the inflamed and ulcerated surfaces twice, and rather more freely on the ulcer itself. It must also be carried somewhat on the

surrounding skin. Lint must then be applied to the ulcer and the whole imflamed and ulcerated parts covered with the neutral ointment,* spread on linen. A compress of linen five or six folds thick is then to be put over the ulcer, and a common roller to be loosely applied round the whole. On the fourth day the leg is to be examined, when it will be found that the inflammation is nearly if not entirely gone, and the ulcer is in a healing state. The nitrate must then be applied on the whole of the ulcer, and once lightly over the skin immediately surrounding it, one or two inches in breadth. The lint, ointment, etc., to be applied as before. Every third or fourth day this is to be repeated until the ulcer is healed. After the first or second application the patient may walk about.

Caustic Potash.—This is the *hydrate of potash.* Also called the *potassa fusa*, or fused potash.

It is prepared by evaporating a solution of potassa in a clean iron vessel over the fire until ebullition ceases and the potassa melts. It is then poured into proper moulds. The best kind of moulds are of iron and of a cylindrical shape.

In this process all the uncombined water is driven off by the action of heat, and the potassa remains in the state of hydrate. It contains one equivalent of potassa 48, and one of water 9, = 57; or in 100 parts, 84 potassa and 16 water.

When perfectly pure, the hydrate of potassa is of a white color. The officinal preparation, however, owing to impurities, is greyish or bluish. It is soluble in water and alcohol, but usually not entirely so, in consequence of the impurities; when pure, it is entirely soluble. It has a very strong affinity for water and carbonic acid, which it attracts rapidly from the atmosphere, and, in consequence of this, it deliquesces. Hence the necessity of keeping it in tightly-stopped bottles.

Purity.—The officinal hydrate contains various impurities, such as peroxide of iron, carbonate of potash, silica, alumina, &c., which exist in the carbonate of potash, from which the solution of potassa is prepared. These, however, do not interfere with the medicinal virtues of the article. They may be separated by digesting it in alcohol, which takes up only the pure alkali; by evaporating this alcoholic solution to dryness and fusing the mass thus obtained.

Effects.—This is the strongest caustic that we possess, and hence was

* ℞. Empl. Plumbi ℔s. ij.
Ol. Oliv. ℔s. ij.
Cretæ pptt. ℥ xvij.
Acetum Distillat. ℔s. ij. M.

The acid and the chalk to be well mixed in a mortar, the lead, plaster, and oil, previously slowly melted together, are next added, and the whole stirred till cool

known by the name of *causticum commune acerrimum.* When applied in the solid form to any part, it quickly destroys its vitality, and extends its action to the parts beneath, forming a slough, which is afterwards thrown off, leaving behind it an open ulcer.

The principal use of this article is to form issues. In using it for this purpose, however, it is necessary to be cautious. As it is very deliquescent, it is apt to spread, and thus extend its effect too far. A piece of adhesive plaster should, therefore, be first applied to the part, with a hole cut in it of a suitable size where you intend making the issue. To this open part the caustic, moistened at one end, should be rubbed until the part becomes discolored or dies. It is then to be washed and a poultice applied. When the eschar separates, the issue is to be continued by keeping a pea in it. It is also used to destroy warts and fungous growths.

Potassa cum Calce.—This is also called the *Causticum commune mitius*, or the *Causticum commune cum calce.* This is prepared by evaporating solution of potassa to one third, and then adding as much newly slacked lime as will bring it to the consistence of a solid paste. This is then to be preserved in well-stopped bottles.

This consists of the mixed hydrates of potassa and lime. It possesses the advantage of being less deliquescent than the caustic potassa. It is, therefore, more manageable. It is milder and slower. Its general action, however, is the same.

When applied, it is made into a paste with rectified spirits.

Arsenious Acid.—Although commonly ranked among them, this article produces effects very different from the simple caustics.

When applied in small quantities to the *sound skin*, it does not produce any effect. When applied in considerable quantities, however, it has been known to cause local irritation, followed by a pustular eruption, and in some cases the constitutional effects of it have been developed. Several cases are recorded in which this article has been applied by mistake to the head for hair powder, and in all these constitutional effects have followed. One proved fatal. When rubbed on the sound skin in the shape of ointment, it produces generally a pustular eruption; sometimes an eschar, and not unfrequently the system becomes constitutionally affected.—(Christison.) When applied to surfaces deprived of the cuticle, the effects are much more energetic. Great local irritation is caused, while the poison is absorbed frequently with great rapidity, and all the constitutional effects of it developed. Applied to eruptions, ulcers, and wounds, it has frequently proved fatal. In its application to ulcerated surfaces, there is a circumstance of great interest which has frequently been noticed; and that is, that while some persons are affected by a single application, "others have had it applied for a length of time without experiencing any other

consequence than the formation of an eschar at the part."—(Christison.) For this two reasons have been assigned. The first is, the difference in the quantity applied. When a large quantity is applied, the part is speedily disorganized, and absorption is thus prevented. On the other hand, where the quantity applied is small, the local effect is trifling, and absorption readily takes place. A second is the condition of the sore to which it is applied. If there be any bleeding vessels, absorption takes place very readily, and the system is easily affected. On the other hand, if there be no bleeding vessels, thise ffect is much less likely to happen.—(Christison, p. 233.)

The practical conclusions to be drawn from the foregoing are important, and they are the following:

1. The arsenic should always be applied strong, so as to disorganize the part as speedily as possible.

2. Before applying it the part should never be prepared by cutting and paring, so as to cause bleeding.

By attending to these precautions, the absorption of the article may probably in many cases be prevented, and many evil effects obviated.

When properly applied to an ulcerated surface, the part is destroyed and sloughs off; a new action is thus created, and a healthier secretion is promoted.

The disease in which arsenic has been chiefly used is *cancer*, and this is the article generally resorted to by empirics. In many cases it no doubt serves a good purpose in improving the character of the sore, and perhaps retarding the progress of the disease. Experience, however, has abundantly shown that it cannot eradicate the disease, while from the absorption the most dangerous and even fatal consequences have resulted. By regular practitioners it is, therefore, in a great measure abandoned.

It is also used in *Lupus* with advantage, and more recently in *Onycha maligna* with great success.—(Pereira.)

Mode of Application.—The best form is the ointment. This is made by rubbing up one scruple of finely-powdered arsenious acid with one ounce of simple cerate. This must be applied with caution and the effects watched.

The preparation used for onychia maligna is arsenious acid grs. ij, spermaceti oint. ℥i.

[HYDRARGYRI SUPERNITRATIS (*the Acid Nitrate of Mercury*).—A solution of the nitrate of mercury in nitric acid, under the name of the acid nitrate of mercury, is much used as a caustic in Paris, and has been adopted by some practitioners in England and the U. States. It is chiefly used in cases of severe and extensive ulceration of the os uteri. It should be applied by a brush, and very great care taken that it does not fall upon the vagina, or touch the healthy tissue of the uterus.—ED.]

CHEMICAL ALTERATIVES.

The two most important classes of chemical alteratives are:

1st. Antacids, or those remedies which obviate acidity of the stomach by combining with and neutralizing the acid.

2d. Lithics, or those remedies which are given to counteract the disposition to form urinary calculi.

I shall speak of each of these in their order.

Antacids. The presence of acid in the stomach is essential to the performance of its functions. It is of course only when this is in excess that it becomes a proper subject for medicinal treatment.

It is not yet well settled what acids are present in the gastric juice, nor in what state they exist in that fluid—some supposing that muriatic, acetic, and lactic acids exist in a free state. Blondelot, on the other hand, denies altogether the existence of free acid in the stomach, insisting that the acidity of the gastric juice depends on the presence of the acid biphosphate of lime. The probabilities are that free acids exist, and that the same acid does not exist in the gastric juice of different animals, nor in that of the same animals at all times; for though the acidity is essential, it seems that this quality in the absence of one acid can be communicated by another. The acids which are thought to exist in the normal state in gastric juice are, as before stated, the muriatic, lactic, and acetic, and it is probable that when acid is in excess, it is by the increase of one or other of these. They are in all cases developed from the food; muriatic from animal food, lactic and acetic from vegetables. It is then to saturate the *excess* of these acids, and not to neutralize the gastric juice, or remove acid from the stomach, still less to render it alkaline that antacids are given; and if you remember,

1st. That the excess of acid is generated from changes in the food.

2d. That these changes depend on imperfect digestion.

3d. That digestion cannot but be imperfect, when there is in the stomach sufficient alkali to neutralize the gastric juice, you will readily understand the reason for a fact, long familiar to practical men, viz. that it is very possible to remove an effect of disease, and yet not remove, but actually aggravate the disease itself. Here the essence of the disease is the disposition in the stomach to produce an undue quantity of acid from the food, and in neutralizing this excess of acid, and thus removing an *effect*, we may aggravate the disposition in the stomach, which is the *disease*.

This injurious effect of antacids may be, in part and for a time, prevented by the use of vegetable bitters, and alkalies ought not to be long used, without giving the tonics; but even with these the evil effects cannot

be prevented entirely, if the remedy is used freely, and for a long time. Always, therefore, discourage the long-continued use of alkalies, especially the too common practice of taking them immediately after each meal.

Magnesia.—Under the head of cathartics this earth has already been noticed, and it was then mentioned that it was used in three forms, viz.—the *sulphate*, the *carbonate*, and the *pure magnesia*, or *magnesia usta*. In either of these two latter forms, magnesia may be used as an antacid. The difference between them is, that when the carbonate is used, large quantities of carbonic acid gas are extricated in the stomach. In some instances the extrication of this gas is objectionable, from the distension of the stomach which it occasions. Generally, however, no harm can arise from it, and the stimulus of the gas is, in many cases, rather grateful than otherwise to the stomach, and whenever nausea and vomiting are present, may be exceedingly beneficial. As an antacid, magnesia is one of the most efficacious articles that we possess. Next to ammonia, it has the greatest power of neutralizing acids of any of the alkalies or alkaline earths. It is peculiar to this article that, when it combines with an acid in the stomach, it proves *purgative*. In this respect it differs from the other antacids.

Mode of Administration.—It may be given in doses of from ʒss to ʒj in milk or water. To correct the flatulence which it occasions, a small quantity of some aromatic may be added. In dyspeptic states of the stomach, a little of the compound spirit of ammonia is frequently beneficial.

Of the pure magnesia the dose may be about one third less than that of the carbonate.

Creta—Chalk.—This is a friable *carbonate of lime*, and is found in great abundance in different parts of Europe. In the South of England, particularly, it exists in great quantities. *Marble* is the hard carbonate of lime. With the acids chalk effervesces, the carbonic acid gas being extricated. With muriatic acid it effervesces violently, and dissolves almost entirely, leaving a colorless solution.

When by levigation and washing the chalk is separated from any impurities that may be associated with it, it is called *Creta preparata*, or *Prepared chalk*. This is the form in which it is used in medicine. As an antacid, it has been and is still used. It differs from magnesia in not producing any purgative effect. On the contrary, it proves absorbent and astringent. It is, therefore, used with much advantage in cases in which magnesia would be improper. The dose of it is from ℈j to ʒj. The common form in which it is prescribed, is that of the chalk mixture.

Lime Water.—This is a limpid, colorless fluid, without smell, and having a strong, styptic, acrid taste. It changes vegetable blues to green. It unites with oil, forming an imperfect soap. When exposed to the air, a

pellicle forms on its surface, which, when it becomes of a certain thickness, cracks and sinks to the bottom. It is then succeeded by others of a similar character. The explanation of this is the following: The lime of the lime water attracts carbonic acid from the air, and forms a carbonate on the surface, which is the pellicle just mentioned. By successive formations the whole of the lime is thus abstracted. It is for this reason that it is necessary to keep lime water in close-stopped bottles.

As an antacid lime water is much used, and is an article of great value. Besides the power which it possesses of neutralizing acid, it has the still further property of dissolving the sordid mucus with which the stomach and bowels are generally loaded in dyspeptic and otherwise debilitated states of these organs. In the same way it proves serviceable in cases of worms by dissolving the slimy mucus in which these animals are imbedded.

The dose is from ℥j to ℥ij, or iij. Where the stomach is irritable, a good form of giving it is, mixed with an equal quantity of milk.

Potash.—Carbonic acid combines with potash in two proportions, constituting a carbonate and a bicarbonate.

(*a.*) *Carbonate of Potassa*—(Salt of Tartar).—As found in the shops, this salt is in white grains, with an alkaline and nauseous taste; it changes vegetable blues to green, and unites with oils and forms soap. On exposure to the air it is very deliquescent, and forms a fluid of the consistence of oil. This salt contains one proportion of carbonic acid with one of potassa. It is soluble in water, but insoluble in alcohol.

(*b.*) *Bicarbonate of Potassa.*—This salt is prepared by passing a stream of carbonic acid gas through a solution of the carbonate of potassa. When it ceases to absorb carbonic acid, it is to be filtered and evaporated slowly until regular crystals form. This salt contains twice as much carbonic acid as the preceding carbonate, or two proportions of acid to one of potassa.

This is white, crystalline, without smell, and having a weak alkaline taste, without any acrimony. On exposure to the atmosphere it does not undergo any change. It is soluble in about four parts of cold water.

Effects on the System.—In their effects, these salts do not differ much. They are both powerfully antacid, and extend their operation from the stomach to the urinary organs, increasing the secretion of urine, and altering the chemical constitution of that fluid. Although possessing the same general properties, however, the bicarbonate has great advantages over the carbonate. It is less nauseous and acrid in its taste, and agrees better with the stomach.

The dose is from grs. x to grs. xxx, in some mucilaginous vehicle.

(*c.*) Liquor Potassæ—(*Solution of Potassa*).—This is another form in which potassa is used. It is prepared by making separate solutions of

carbonate of potassa and caustic lime in boiling water, and then mixing these together, and when cold, straining, etc. Here the lime attracts the carbonic acid from the potassa, and leaves the alkaline base in a state of purity. To prevent its absorbing carbonic acid from the atmosphere, it should be kept in glass bottles, with ground stoppers.

The *liquor potassæ*, when pure, is a limpid, colorless fluid; its taste is acrid and caustic. It changes vegetable blues to green, and does not effervesce with acids. It is a powerful antacid, and extends its operations to the urinary organs. It does not, however, appear to possess any advantage over the carbonate, and is more apt to disagree with the stomach. The dose is from gtt. x to gtt. xxx, taken in broth, milk, common table beer, or some bitter infusion.

Soda.—Like Potassa, Soda combines with carbonic acid in two proportions.

(*a.*) Carbonate of Soda.—This salt is in large, white crystals. It is without smell. On exposure to the atmosphere it effloresces and crumbles into a white, opaque powder. It consists of one proportion of carbonic acid and one of soda.

(*b.*) Bicarbonate of Soda.—This salt is prepared in the same way as the bicarbonate of potassa, and contains two proportions of the acid to one of the soda. It forms in crystals—less soluble in water than the carbonate. When dried, these crystals effloresce and lose part of their carbonic acid, so that what is usually found in the shops under the name of the carbonate is intermediate between the carbonate and bicarbonate, forming a *sesquicarbonate of soda*. [A mixture of the two carbonates.—Graham.]

Effects on the System.—The carbonates of soda are analogous in their operation, the only difference being that the bicarbonate is less alkaline and unpleasant in its taste, and generally sits better on the stomach. The carbonates of soda are generally more used than those of potassa. They are more pleasant, sit easier on the stomach, especially if their use is to be continued, and at the same time appear to be more efficacious. The dose is from grs. x to grs. xxx or xl, dissolved in water or almond mixture. A very pleasant mode of giving soda is in *soda water*. The taste of the soda is here almost entirely covered by the carbonic acid.

Carbonate of Ammonia—(*Volatile alkali*).—This salt does not exist in nature, but forms spontaneously in the decomposition of animal matter. It is also prepared artificially for medicinal purposes.

It has a penetrating pungent odor, and an acrid taste. It is usually in white semitransparent masses of a crystalline appearance. On exposure to

air it effloresces. It should be kept in well stopped bottles, for when exposed to the air, it gradually loses ammonia, becomes opaque, pulverulent and less pungent, and ultimately passes into a *hydrated bicarbonate of ammonia.* It possesses alkaline properties, and is soluble in about three parts of cold water.

Effects.—As an antacid this salt possesses very active properties. Besides neutralizing acid, which it does very effectually, it has the advantage of being powerfully stimulant, and is on this account particularly useful in debilitated states of the stomach, accompanied with acidity and flatulence.

Form.—*Pill* or *bolus*, in doses of from ij grains to x grs.

CHEMICAL ALTERATIVES.

Lithics.—Under this head I shall treat of those remedies which are calculated to correct some of the more common morbid states of the urine which are manifested by deposits. To make this subject intelligible, it is necessary to say a few words on the urine in health. Healthy urine, when recently voided and yet warm, is an amber-colored fluid, having a peculiar aromatic smell, and a saltish, disagreeable taste. On cooling the smell changes to that usually called urinous, which it retains till it begins to decompose, when it has a fœtid, ammoniacal odor. Its specific gravity may vary from 1005 to 1030, but its usual range is from 1015 to 1020. The quantity voided is subject to remarkable variations, even in perfect health, sometimes falling below 20 ounces, and at others exceeding 50. The average is about 32, or two pints. The quantity of solid matter in the urine is, like all its other qualities, subject to vary from a great number of causes. Its average is about 64 grains in 24 hours. This supposes that 32 ounces of urine of the specific gravity of 1020 are passed, each ounce of the fluid containing 20 grains.

Not only does the urine of different persons, and of the same persons at different times, vary, but there is a pretty regular change which the fluid, in all healthy persons, undergoes at different periods of the day. That passed after rising from bed in the morning, and of course after several hours of abstinence from food or drink, is commonly called *urina sanguinis.* It furnishes a fair specimen of the average density of the whole urine. That passed soon after the digestion of a full meal, called *urina chyli,* is of high specific gravity, while that which flows after the taking of large draughts of water, called *urina potûs,* has a low specific gravity, is of pale color, and is sometimes nearly pure water. The urine is a very complex fluid, and the chemists are scarcely yet agreed as to its composition. Into the niceties of this analysis I need not enter: my purpose will be served by calling your attention to a very general view of its composition.

It contains in one thousand parts:

1. Water	from	930	to	960
2. Urea,		24	to	14
3. Uric acid,		1·3	to	0·90
4. Alkaline and earthy salts,		15	to	5
5. Other solid matters,		30	to	20

Of the constituents of urine the most important are urea, uric acid, and the alkaline and earthy salts, these latter being chiefly phosphates of soda, lime and magnesia, sulphates of potash and soda, muriate of ammonia, and chloride of sodium or common salt. The proportion of these several ingredients may vary very much without exceeding the limit of health. When, however, the quantity of any one is very much either increased or diminished it constitutes, not always a disease—this is a matter of great importance and to be kept always in view—but a *symptom of some diseased state* of the system, very generally connected, more or less intimately, with faulty digestion. But the urine becomes morbid, not only by the faulty proportions of its normal ingredients, but it sometimes contains matters which are not properly constituents of the fluid; of these the most important are albumen, sugar, pus, blood, and bile. None of these are ingredients in healthy urine, yet, even their presence is not always to be taken as an evidence of disease; it may be that they exist there in consequence of the vigorous efforts the system is making to eliminate noxious matters.

From what is above stated it is obvious that morbid states of the urine may be divided into two general classes:

I. Those in which some normal constituent of the urine is in excess.

II. Those in which the urine contains some principle which is not found in it in the state of health.

1. *Morbid states of the urine in which some normal ingredient is in excess.*—The normal ingredients of the urine which are most frequently found in excess are:

1. Urea; 2. Uric acid and the urates; 3. The phosphates.

1. *Urine in which urea exists in excess.*—Urine in which urea is in excess has a high specific gravity, and is very prone to decomposition; it has no other peculiar physical property.

Test.—Add to a small quantity of urine in a watch glass about an equal quantity of pure colorless nitric acid; if crystals appear urea is in excess, and the time within which they form, which may vary from a few minutes to two or three hours, and the quantity of crystals, will enable us to judge of the amount of the excess; or put two or three drops of urea in a plate of glass and add two or three drops of nitric acid; if crystals form they can be detected by the microscope: and by a comparison of healthy urine tested in the same way, a good idea of the quantity of urea may be formed.

Symptoms.—A frequent desire to void urine, though the quantity passed at one time is commonly moderate. The quantity voided in twenty-four hours may not much exceed the normal standard, though it commonly does a little, but a remarkable feature of the disease is the facility with which diuresis is produced by trifling causes, as anxiety, a slight chill of the surface, and the like. There is pain in the back, indisposition to exercise, low spirits, with dyspeptic symptoms of greater or less severity.

2. *Urine in which lithic acid or the lithates predominate.*—Urine containing excess of lithic acid is usually of a high color, and if the excess is considerable the acid is deposited as the urine cools. It always appears as crystals, though they are often so small as only to be recognised by the microscope.* The urine is acid, but not of high specific gravity, unless, as not unfrequently happens, there is excess of urea.

Lithate of Ammonia.—This is often seen with lithic acid, and the urine containing it is usually high-colored and turbid, sometimes it is clear when passed, and of low specific gravity. The lithate is deposited as the urine cools as an amorphous mass. It has commonly a fawn color, verging towards red. It is the most common of the urinary deposits. The only one with which it can be confounded is earthy phosphates, and from them it is distinguished by being redissolved when the urine is heated and falling down again when it cools. It is dissolved by adding liquor potassæ. Lithate of soda is usually found, and sometimes in very large quantities, in urine containing lithate of ammonia; this is particularly true of the urine of gouty patients, in whose systems lithate of soda often abounds to such a degree that it is deposited in the joints, forming the so-called chalk stones. It has also been found in the blood of arthritics.

Lithic acid and the lithate are also found in excess in the urine, in most cases of inflammatory disease, in rheumatism and gout. It is very common in fever. It is often increased by check of perspiration from cold, and sometimes accompanies chronic skin disease. When too much animal or highly nitrogenized food is taken, or the digestive organs are impaired so that they are unable to assimilate the usual quantity, the excess of nitrogen will often be eliminated from the kidneys as lithic acid and lithates. This is one of the cases where the presence of an urinary deposit is evidence of the efforts of the system to eliminate a noxious principle. On the other hand, in all diseases of debility, in anemia, hysteria, chlorosis, the quantity of lithic acid is below the normal standard.

Therapeutics.—Where this acid or the lithates are in excess, the treatment must of course be directed by two indications.

* The color is yellow or red, varying through all the shades of pale and deep fawn color to intense orange red.

I. To remove the diseased state upon which the disposition to form acid in excess depends.

II. To promote the solution of the acid and its salts.

The means for fulfilling the first indication are:

1. Those calculated to restore the healthy functions of the skin, and promote diaphoresis.

2. Those which improve digestion.

Of the former the most available are the warm or vapor bath, followed by very free and even violent friction of the whole surface, and moderate exercise; these hygienic measures will often produce the best effects.

To improve the digestion, alteratives, and, if needful, mild tonic laxatives, as rhubarb, and soda or magnesia, may be followed by vegetable tonics, and in some cases chalybeates. Of the preparations of iron those are to be preferred in which the metal is united to an organic acid, as the ammonio-tartrate, the citrate, or lactate.

Attention to diet is all-important; here, as in most other cases, the best rule is to take such articles only, and in such quantities, as the patient finds by experience he can thoroughly digest.

Solvents of lithic acid and the lithates.—These are the proper and literal *lithics.* Their use is generally secondary to that of the remedies which have been mentioned as proper to remove the diseased state of the system on which the formation of the excess of acid depends. Still they are of importance, for they may ward off for a while the dreaded evil calculus, and give time for the proper operation of the other and more important class of remedies.

Of the solvents of lithic acid the most important is *water.* This is the best lithic, not only for this, but for most other urinary deposits. All other lithics will usually fail, hardly acting at all, unless their operation be aided by free dilution; and, on the other hand, very many of them act promptly, and with great power, when presented to the system with plenty of water. Two or three pints a day is the proper quantity to be taken, and if a larger amount can be swallowed without impairing the digestive powers, the chance of the acid being "*washed away*" is greatly increased. A very curious proof of the efficacy of water as a lithic is afforded by the Medical History of Malvern Springs in England. These waters have, for a very long time, enjoyed great reputation in cases of gout, gravel, and other chronic affections; to their efficacy we have the testimony of Prout, Bird, and other writers. Now the water of Malvern Springs differs, except as to temperature, from common spring water, solely in its extreme purity, approximating that of distilled water.

Potash.—This alkali may be given in various forms, as the liquor potassæ, the carbonate, bicarbonate, tartrate, citrate, and acetate. The liquor potassæ should be given in full doses, say ʒss. thrice a day in some

mild fluid, a weak, bitter infusion. It is apt even in this form to offend the stomach, and its use cannot be persisted in a long time without seriously impairing the digestion. The bicarbonate of potash is a very efficient and rather pleasant lithic, it may be given in doses of ʒss. thrice a day. It is made more pleasant and grateful to the stomach by giving it with a few drops of some weak acid, acetic or citric, to be taken in the state of effervescence; here the citrate and carbonate are taken together, in proportions which vary as more or less acid is added. If sufficient is added to drive off all the carbonic acid, you then have, of course, a solution of the salt of the vegetable acid, and this is the best way of taking citrate or tartrate of potash.

Acetate of Potash.—This is the best lithic salt of potash. It is less apt than the others to disorder the digestion, and by the use of the full dose ʒss three times a day, the urine may be kept alkaline, and the lithic acid diathesis kept in check for a long time. Still it must never be forgotten that this alkaline state of the urine may induce the formation of deposits of the phosphates, nor will the stomach always escape an evil influence even from this alkali.

Salts of Soda.—Of these, those chiefly used are lithics, the carbonate, the borate, the phosphates, and the salts of vegetable acids, in the form of effervescing mixtures. The carbonate is inferior to the salt of potash—so also are the salts formed with vegetable acids, though they are very much used in the form of soda powders.

Borate of Soda—(Borax).—The virtues of borax as a lithic have long been celebrated among the Germans, and much relied on from the power its solution has of dissolving lithic acid; in this it excels either of the alkaline carbonates. It has, too, the advantage that it can be used for a considerable length of time without any bad effects on the digestion. It is said to have a stimulating influence on the uterus, and to be on that account objectionable in females. Dr. G. Bird says he has known it to produce abortion in two cases.

Phosphate of Soda.—The solvent powers of the solution of this salt are equal to those of borax, and it has been used as a lithic in many cases; its agreeable taste is a great recommendation; it seems to sit well on the stomach if given in a state of sufficient dilution.

Dose.—ʒi to ℥ss twice a day. It may be taken in broth or gruel; its taste very nearly resembling that of common salt. In concluding the subject of the alkaline treatment of lithic acid, it is proper to repeat that alkalies exert no curative influence on lithic acid deposits. The benefit to be derived from their use is palliation, and not cure. They correct acidity in the products of mal-assimilation, and for this purpose should be given in moderate doses, two to four hours after eating.

Urine in which Phosphates are in excess.—Urine containing phosphates

in excess is usually pale and of light specific gravity, 1.010, and secreted in large quantity.* It is usually acid when passed, but soon becomes alkaline when the phosphates fall in large quantity, as they are not in the absence of acid soluble in the urine. Unless the urine becomes alkaline this deposit (spontaneous) of phosphates will not take place, even though they exist in very great quantity. The phosphatic deposit is white, or yellowish, or greyish white; it is readily dissolved by adding hydrochloric acid, and reappears when this acid solution is supersaturated with ammonia; they are not affected by adding the alkalies or their carbonates, nor are they dissolved by heating the urine. On the contrary, if they exist in excess, the urine, though previously clear, is made turbid by boiling, so that we might suppose albumen was present. Adding nitric acid pretty freely to the urine will, by dissolving the phosphates, render it plain that albumen is not present.

States of disease in which Phosphates occur in excess.—If the excess is but occasional, and varying in degree even when present—if the urine be deep-colored and of high specific gravity, the cause of the deposit is dyspepsia. The particular form of this disease in which we find these deposits, is that connected with great irritability, both of the system at large and the stomach, prostration of nervous energy, and general evidence of wear and tear of body and mind. When the urine is pale, of low specific gravity, and when the phosphates abound equally at all times of the day, and when this state of things continues for a considerable time, the phosphatic deposit probably depends either on organic disease of the bladder, prostate, or kidney, or some morbid state of the spine, consequent on injury or idiopathic disease.

Therapeutics.—The deposit of phosphates very generally indicates a severe, and accompanies a number of utterly uncurable diseases. The prognosis is, therefore, always grave when the deposit is constant. When it is but occasional, it generally depends, as before stated, on an irritative form of dyspepsia, but even here the probability is, that the nervous system is suffering severely. Very little can be done by lithics proper, in either of these forms of disease. Some practitioners have strongly commended acids with a view of directly correcting the alkaline state of the urine. It is very doubtful whether either of the mineral acids have any such power, though some have attributed it to the nitric.

Benzoic acid has been highly praised, but its operation is excessively uncertain. These cases must be treated on general principles, and with particular reference to the disturbed state of innervation. Narcotics will

* Sometimes the urine containing excess of phosphates is high-colored, and of great specific gravity; this usually occurs where the precipitate depends on dyspepsia, and is only occasionally present.

always be required, and in many cases you will give them very freely. Tonics and alteratives judiciously combined, a well-regulated, plain, though nutritious diet, and good hygienic management, will do all that art can do for the more severe cases.

THE END.

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